S. HRG. 100-210

ISSUES CONFRONTING THE SEMICONDUCTOR INDUSTRY

HEARINGS

BEFORE THE

SUBCOMMITTEE ON
TECHNOLOGY AND THE LAW

OF THE

COMMITTEE ON THE JUDICIARY
UNITED STATES SENATE

ONE HUNDREDTH CONGRESS

FIRST SESSION

ON

S. 442

A BILL TO AMEND SECTION 914 OF TITLE 17, UNITED STATES CODE, REGARDING CERTAIN PROTECTIVE ORDERS

FEBRUARY 26 AND MARCH 3, 1987

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ISSUES CONFRONTING THE SEMICONDUCTOR INDUSTRY

THURSDAY, FEBRUARY 26, 1987

U.S. SENATE,
SUBCOMMITTEE ON TECHNOLOGY AND THE LAW,
COMMITTEE ON THE JUDICIARY,
Washington, DC.

The committee met, pursuant to notice, at 10:05 a.m., in room SD-226, Dirksen Senate Office Building, Hon. Patrick J. Leahy (chairman of the subcommittee) presiding.

OPENING STATEMENT OF SENATOR PATRICK J. LEAHY, A U.S. SENATOR FROM THE STATE OF VERMONT

Senator LEAHY. The Subcommittee on Technology and the Law will come to order. This is the first meeting of this new subcommittee and I am delighted to see the turnout and I am pleased that Dr. Kerber and the others can be here this morning.

I think this is going to start a series of hearings that will have enormous impact on the whole country and certainly on the semiconductor industry.

This subcommittee is the forum within the Judiciary Committee for the development of laws and the promotion of regulatory plans or schemes to encourage innovation and high technology and to promote industrial competitiveness in the computer age. So it is good to start with a hearing on issues confronting the semiconductor industries.

Semiconductor chips, as most people here know far better than I, are at the heart of the worldwide computer revolution. In fact, all America should be proud that the chip is an American invention. It is a great interest in my own home State of Vermont, a State that has seen a transition from basically an agricultural economy now to very much of a high tech, and education-oriented economy.

In the past, I have worked with a number of the witnesses here not only on the needs of the semiconductor industry but also on questions that I had regarding the affect the industry has on my own State of Vermont.

One of the major accomplishments during the 98th Congress resulted from work done along with Senator McC. Mathias, one of the most distinguished members I have ever had the honor to serve with, and Congressmen Bob Kastenmeier, Don Edwards, and Norm Mineta. Together, we developed the Semiconductor Chip Protection Act of 1984.

The 1984 Act created the first wholly new form of intellectual property in over 100 years. That I found of some interest, partly because it reflected the enormous change that occurred in our whole concept of intellectual property during that time.

We drafted the law so that it would become the worldwide standard. We put in it incentives for other countries to enact equivalent protection. That act has been in place for two years. One of the reasons I wanted to hold this hearing is that the subcommittee wants to know if the reciprocity provisions of the Chip Act are meeting our objectives. Have we adequately protected American chip design? Have we promoted chip protection in the rest of the world?

First, Dr. Kerber, from the Defense Department, is going to discuss the Defense Science Board Task Force Report on Semiconductor Dependency.

I want to be sure, secondly, that the 1984 Semiconductor Chip Protection Act itself is working. We do not want to pass it and then forget about it. Thirdly, my bill, S. 442, the Semiconductor Chip Protection Act Extension, extends the Secretary of Commerce authority under Section 914 of the 1984 Act to issue interim orders granting U.S. protection for the chip designs of those countries making adequate progress toward laws protecting U.S. chips.

My bill extends the Secretary's authority for three years. Now, I have talked with some of our witnesses before and you have suggested alternative kinds of extensions. The 3 years recommended in my bill is there to give us an area toward discussion. I am not set in concrete on that. I will be happy to listen to any other suggestions.

I think experience shows that we may want to consider legislation to open up the Presidential proclamation process. I have asked several witnesses before us today and others who will testify in next week's hearings to address that option specifically. In fact, when we resume on Tuesday, we are going to take a look at the present condition of, and future prospects for, the U.S. semiconductor industry. I was disturbed to learn that America may be losing its place in the world semiconductor chip market. It is particularly unsettling if you view the potential adverse effect this would have on our Nation's defense capability.

We are going to hear about several proposals to reinvigorate the industry that gave rise to the international technological revolution.

We are going to be considering these proposals in close conjunction with another subcommittee, the Patents, Copyrights and Trademarks Subcommittee. The chairman of the Patents Subcommittee, Senator DeConcini, is a member of this subcommittee and I am a member of the Patents Subcommittee, so we will be able to have a close working relationship. Senator Humphrey from New Hampshire, the ranking minority member of this subcommittee, also is concerned because his State, like mine, is becoming more and more of a high tech State.

At this point I wish to place a prepared statement of Senator Humphrey in the record, along with the text of S. 442.

[The aforementioned follows:]

PREPARED STATEMENT OF HON. GORDON J. HUMPHREY, A U.S. SENATOR FROM THE STATE OF NEW HAMPSHIRE

This initial hearing of the Judiciary Subcommittee on Technology and the Law comes at an extremely opportune time.

Today, dramatic advances in technology are producing major changes in government, industry, and private life at a rate that is difficult to comprehend. The revolutionary changes in communications, science, and technology produced by the computer age are creating a whole host of new benefits, challenges and problems. In some areas, we may need to develop new policies and new laws to cope with these critical changes.

I hope that this new subcommittee will be able to make a significant contribution in that regard, and I look forward to working with Chairman Leahy and Senator De Concini towards that end. I believe there is substantial opportunity for cooperative, bipartisan efforts in this area.

Today's hearing confronts a topic of great importance to the Nation's economic and technological welfare, as well as to national security.

The challenges facing the U.S. semiconductor industry are so complex and multifaceted that no single committee or subcommittee could deal with them comprehensively. But this subcommittee can perform a useful service by identifying some of the areas where legislative measures may be useful in helping the U.S. semiconductor industry reassert its competitive edge. I look forward to any suggestions or recommendations the witnesses may have in that regard.

I also look forward to hearing from the administration and industry witnesses concerning progress made in establishing reciprocal protection for chip designs under the Semiconductor Chip Protection Act of 1984 and the need for extending or improving the provisions of that act.

II

100TH CONGRESS
1ST SESSION

S. 442

To amend section 914 of title 17, United States Code, regarding certain protective orders.

IN THE SENATE OF THE UNITED STATES

FEBRUARY 3, 1987

Mr. LEAHY introduced the following bill; which was read twice and referred to the Committee on the Judiciary

---

A BILL

To amend section 914 of title 17, United States Code, regarding certain protective orders.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Section 914(e) of title 17, United States Code, is amended by striking out "three years after such date of enactment" and inserting in lieu thereof "on November 8, 1990".

○

Senator LEAHY. Dr. Kerber, we will lead off with you and I would hope, in your discussion, that you will tell us whether the Administration's plan is to create a semiconductor industry consortium funded by the Defense Department which would be the sole supplier of Defense Department needs? It is all yours.

STATEMENT OF HON. DR. RONALD L. KERBER, DEPUTY UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ADVANCED TECHNOLOGY, ACCOMPANIED BY EGBERT MAYNARD, DIRECTOR OF COMPUTER AND ELECTRONICS TECHNOLOGY

Dr. KERBER. Thank you, Mr. Chairman.

I am Ron Kerber, Deputy Under Secretary of Defense for Research and Advanced Technology and it is a pleasure to appear before the committee to discuss with you the growing problem of U.S. dependency on foreign suppliers for semiconductors used in weapon systems. I have with me today Mr. Egbert Maynard, Director of Computer and Electronics Technology, for the purpose of answering any questions you may have in his particular area of responsibility.

I have a brief prepared statement, which I would like to present to the committee and have placed in the record.

Senator LEAHY. Without objection, so ordered.

Dr. KERBER. The information which I share with you today has strong interest among government and industrial leaders who recognize the need to implement innovative approaches to support an industry critical to U.S. economic and military leadership.

In December of 1985, the Defense Science Board was requested to organize a task force to address the impact of the dependency of the U.S. military on foreign sources for semiconductor devices. The task force, chaired by Mr. Norm Augustine, president of Martin-Marietta Corp., recently completed a 10-month effort during which it solicited input from all interested parties through an announcement in the Federal Register, interrogation of over fifty expert witnesses, and a significant literature survey on the subject. Mr. Augustine is scheduled to appear before this committee next week.

The task force concluded that while our current dependency on foreign sources is modest today, semiconductor manufacturing trends indicate that we will become highly dependent on foreign sources soon if actions are not taken. The most significant finding of the task force was that U.S. semiconductor technology leadership is rapidly eroding.

This has serious implications for the nation's economy and national security. In their words:

> U.S. defense strategy relies upon technically superior weapons to overcome the numerical advantage of our adversaries. Our capability to field technologically superior weapons may soon, however, be dangerously diminished. The superiority of U.S. defense systems of all types is directly dependent upon superior electronics, a force multiplier which not only enhances the performance of the weapon systems themselves, but also maximizes the efficiency of their application through sophisticated intelligence, command and control systems."
>
> Electronics therefore is the foundation upon much of which our defense strategy and capabilities are built. The United States has historically been a technological leader in electronics. However, superiority in the application of innovation no longer exists. The relative stature of our technology base in this area is steadily deteriorating.

In the 1960's, the Department of Defense was the dominant procurer of semiconductors in the United States. As a result of a fortuitous synergism between the needs of the private sector and defense, the semiconductor industry was able to grow rapidly. Today, however, the military acquires less than three percent of the quantity output of the semiconductor industry. Therefore, although semiconductors are of great importance to national security, the defense market is not of great importance to the semiconductor industry.

Significant gains in military capability have been achieved by the application of modern electronics technology. For example, sensors have more than doubled missile warning time and greatly expanded geographical coverage. Lightweight electronics has permitted the creation of airborne radar capable of monitoring over a million cubic miles of space for early warning.

Electronics have impacted the traditional weapons systems also. Recent advances in armor technology include the ability to fight at night while using only passive sensors, to shoot while moving and to hit targets at extended ranges with the first round, therefore reducing the exposure to hostile fire. So the Defense Department has really relied very, very significantly on the ability of electronics to give us this technological multiplier and force multiplier.

The world market for electronics, including computers, telecommunications equipment, consumer products, industrial process control equipment, scientific instruments, and defense systems, has grown at an extraordinary rate over the last three decades. This market reached $200 billion in 1983, more than doubling the 1977 figure. In the 1990's, the world market for electronics is expected to be around $500 billion, growing to over a trillion dollars by the year 2000. This figure places electronics, already the number one employer in the U.S. with over 2.5 million jobs, as one of the world's leading industries.

Semiconductors are the heart of all electronics systems. Leadership in semiconductor technology and associated manufacturing is key to leadership in the electronics industry.

Since the 1960's, semiconductors have fundamentally altered communication, education, health care, recreation, entertainment, and work activity. This technology is key to information processing, communication, and computing technology which are vital to critical national security and economic well being.

The findings of the Defense Science Board on the cause of this trend are, not surprisingly, nearly all related to competition from Japan. Japanese aggressiveness has elevated them from a 20-percent market share to world leadership and domination in one decade.

Neither the Department nor the Defense Science Board intend this report to be interpreted as anti-Japanese. On the contrary, the Japanese are to be commended for having the foresight and fortitude to focus their national resources on an industry and a technology which is so fundamental to leadership in electronics and is the enabling technology for automated manufacturing, the key to manufacturing excellence. However, their impact on U.S. strategy and U.S. industry cannot be ignored.

The Defense Science Board has made specific recommendations to the Department which they feel will redress the effects of the current trends on U.S. military capability. They are, as you mentioned, number one, to support the establishment of a semiconductor manufacturing technology institute. Number two, to establish centers of excellence in semiconductor science and engineering. Number three, increase emphasis in the DOD technology base programs in this area. Number four, provide discretionary R&D credits to defense semiconductor parts suppliers. And finally, number five, to establish a government industry university forum on semiconductors to facilitate joint action in semiconductor research, development and manufacturing.

These recommendations, if fully implemented, would require Defense Department dollars to be allocated in the range of $400 to $500 million per year of additional resources. Since inaction on our part has grave consequences, these recommendations are being carefully considered within the Department. A comprehensive plan will be developed within the next 60 days.

I must point out that the Defense Science Board's recommendations were tailored to actions that the Department must take to redress the impact on Defense. These actions alone will not solve all the problems facing the industry. If we are to avoid a situation where the Defense budget must perpetually sustain an expensive Defense only semiconductor capability, it is imperative that action must be taken by the Department, other government agencies and most importantly by industry itself, to revitalize the industry to a point where healthy, competitive U.S. corporations once again produce in the private sector the technology we need to assure the best military capability.

What needs to be done? We need to define a winning strategy. That strategy must, of necessity, redress impediments to successful competition in global markets which fall outside the purview of the Department of Defense. Such issues may include special legislation to permit cooperation among the industry for the development of manufacturing technology, creative solutions to reduce the cost of capital, incentives which encourage saving on the part of individuals, and incentives which allow industry to focus on long-term solutions instead of next quarter's earnings.

[Prepared statement follows:]

STATEMENT BY

DR. RONALD L. KERBER

DEPUTY UNDER SECRETARY OF DEFENSE
FOR
RESEARCH AND ADVANCED TECHNOLOGY

Mr. Chairman and Members of the Committee:

I am Ronald L. Kerber, Deputy Under Secretary of Defense for Research and Advanced Technology. I appreciate the opportunity to appear before the Committee today to discuss the growing problem of U.S. dependency on foreign suppliers for semiconductors used in weapon systems and the problems associated with the long-term viability of this segment of the U.S. industrial base to continue to be the principal supplier of electronics to the Department of Defense and its system contractors. I have with me today Mr. Egbert Maynard, Director of Computer and Electronics Technology, for the purpose of answering any questions that you may have with particular reference to his area of responsibility.

I have a brief prepared statement which I would like to present to the Committee.

The information which I share with you today has created strong interest among government and industrial leaders who recognize the need to implement innovative approaches to support an industry critical for U.S. economic and military leadership.

In December 1985, the Defense Science Board was requested to organize a Task Force to address the impact of dependency of the U.S. military on foreign sources for semiconductor devices. The Task Force, chaired by Mr. Norman Augustine, President of

Martin Marietta Corporation, recently completed a 10-month effort during which it solicited input from all interested parties via an announcement in the Federal Register, interrogation of over fifty expert witnesses, and a literature survey on the subject.

The Task Force concluded that while our dependency on foreign sources is modest today, semiconductor manufacturing trends indicate that we will become highly dependent on foreign sources soon if immediate actions are not taken. The most significant finding of the Task Force was that U.S. semiconductor technology leadership is rapidly eroding and that this has serious implications for the nation's economy and national security. In their words, "U.S. Defense strategy relies upon technologically superior weapons to overcome the numerical advantage of our adversaries. Our capability to field technologically superior weapons may soon, however, be dangerously diminished. The superiority of U.S. defense systems of all types is directly dependent upon superior electronics, a force multiplier which not only enhances the performance of the weapon systems themselves, but also maximizes the efficiency of their application through sophisticated intelligence and command and control systems. Electronics technology is therefore the foundation upon which much of our defense strategy and capabilities are built. The United States has historically been the technological leader in electronics. However, superiority in the application of innovation no longer exists and the relative stature of our technology base in this area is steadily deteriorating."

In the 1960's, the Department of Defense was the dominant procurer of semiconductors in the United States and it was because of a fortuitous synergism that existed between the needs of the private sector and defense that the semiconductor industry was able to grow so rapidly. Today, however, the U.S. military acquires less than three percent of the quantity output of the semiconductor industry. Thus, although

semiconductors are of major importance to the national security, the Defense market is not of great importance to the semiconductor industry.

A number of technologies contribute to maintaining the strength of modern military forces. However, electronics gives us the ability to sense, locate, acquire, track, identify and destroy potential targets. It sorts, compiles, assimilates, and computes wide varieties of complex real-time data. It allows us to aim, launch, and guide various munitions with precise accuracy anywhere in the world and under any conditions. It extends the minds and muscle of our military personnel so that they may continue to serve as a deterrent to potential adversaries.

Significant gains in military capability have been achieved by the application of modern electronics technology. For example, sensors have more than doubled missile warning time and greatly expanded geographical coverage. Lightweight electronics has permitted the creation of airborne radar capable of monitoring over one million cubic miles of airspace from a single platform without the gaps for low altitude penetrators to use. Electro-optical fire control systems now enable tactical attack aircraft to engage several targets on a single pass even during night-time conditions. And finally, electronics technology has impacted traditional weapon systems. Recent armor advances include the ability to fight at night using only passive sensors, to shoot while moving and to hit targets at extended ranges with the first round, thereby reducing exposure to hostile fire.

The world market for electronics - including computers, telecommunications equipment, consumer products, industrial process control equipment, scientific instruments and defense systems - has grown at an extraordinary rate over the last three decades. This market reached $200 billion in 1983, more than doubling the 1977 figure. In the 1990's, the world market for

electronics is expected to be around $500 billion growing to over a trillion dollars by the year 2000. This figure places electronics, already the number one employer in the U.S. with over two and one-half million jobs, as one of the world's leading industries.

Semiconductors are the heart of all electronic systems. Leadership in semiconductor technology and associated manufacturing is key to leadership in the electronics industry. Semiconductor chips are descendants of vacuum tubes and transistors. Using modern manufacturing technology, it is possible to place on a single chip the equivalents of millions of vacuum tubes. By the end of the century, it may be possible to store a billion bits of information on a single chip. A "bit" is the smallest unit of information; a large book contains on the order of one million bits.

Semiconductor chips, or integrated circuits as they are more formally known, offer numerous advantages including small size, low cost, minimal power demand, high reliability, and very high speed. They have been referred to, not inappropriately, as "industrial rice" or as the "crude oil of the Information Age". In 1987, the world market for integrated circuits is expected to approach $30 billion. This dollar value only partly reflects the importance of semiconductors in transforming modern industrial society. They have played a central role in the development of new industries such as data processing, robotics, and much of the consumer electronics market. Since the 1960's, semiconductors have fundamentally altered communications, education, health care, recreation, entertainment, and work activity. This technology is the key to information processing, communication, and computing technology which is vitally critical to national security and economic well being. This testimony was prepared on a personal computer, transferred electronically to a word processor for final editing, printed on a laser printer and reproduced on an electronically controlled copying machine. The irony is that the majority of the

semiconductors used were produced in whole or in part in foreign countries.

The findings of the Defense Science Board on the cause of this trend are, not surprisingly, nearly all related to competition from Japan. Japanese aggressiveness has elevated them from a 20 percent market share to world leadership and domination in one decade.

Neither the Department nor the Defense Science Board intend this report to be interpreted as anti-Japanese. On the contrary, the Japanese are to be commended for having the foresight and fortitude to focus their national resources on an industry and a technology which is so fundamental to leadership in electronics and is the enabling technology for automated manufacturing - the key to manufacturing excellence. However, the impact of their successful strategy on U.S. industry can not be ignored.

The Defense Science Board has made specific recommendations to the Department which they felt would redress the effects of current trends on U.S. military capability. They are: 1) support the establishment of a Semiconductor Manufacturing Technology Institute, 2) establish centers of excellence in semiconductor science and engineering, 3) increase emphasis in DoD technology base programs, 4) provide discretionary R&D credits to defense semiconductor parts suppliers and 5) establish a government/industry/university forum on semiconductors to facilitate joint action in semiconductor research, development and manufacturing.

These recommendations, if fully implemented, would require the Defense Department to allocate $400 million to $500 million dollars per year of additional resources. As inaction on our part has grave consequences, these recommendations are being carefully considered within the Department. A comprehensive plan will be developed in the next sixty days.

I must point out that the Defense Science Board's recommendations were tailored to actions that the Department must take to redress the impact on Defense. As they point out, these actions alone will not solve all the problems facing the industry. If we are to avoid a situation where the Defense budget must perpetually sustain an expensive "Defense only" semiconductor capability, it is imperative that action must be taken by the Department, other government agencies and most importantly by the industry itself, which would revitalize the industry to a point where healthy, competitive U.S. corporations once again produce in the private sector the technology we need to assure the best military capability.

What needs to be done? We need to define a winning strategy. That strategy must, of necessity, redress impediments to successful competition in global markets which fall outside the purview of the Department of Defense. Such issues may include special legislation to permit cooperation among the industry for the development of manufacturing technology, creative solutions to reduce the cost of capital, incentives which encourage savings on the part of individuals, incentives which allow industry to focus on long-term solutions instead of next quarter's earnings, revitalization of the technical education of America's youth at all levels and international trade policies which permit the U.S. industrial base to compete on a level playing field in global markets.

We in the Defense Department are working with industry, the Office of Science and Technology Policy, the Departments of Commerce and Energy and the National Science Foundation to develop this winning strategy. The industry is the key to its own health and it must take a major leadership role in regaining this technology. We must look at futuristic supporting technologies, such as processing equipment, packaging and testing technology, the future role of optical and even bio-processing technology. We need to also look at the economic and political barriers to success. I can think of no other industry

which straddles the thresholds to the doorways of technological leadership, industrial competitiveness, and creation and preservation of jobs and national security.

I appreciate this opportunity to appear before the Committee and shall be happy to answer any questions you may have.

Senator LEAHY. There are a number of other issues, too. One is to try to tackle our huge budget deficit, which seems to be paid for by taking money out of education, and thereby limiting our ability to have additional generations of well trained young people who can compete in high technology.

I still go back to the initial question. Is it the Administration's plan that there be a consortium funded by the Defense Department to be the sole supplier of the Defense Department's needs in the semiconductor area?

Dr. KERBER. I think there are certain processing technologies that are important to the development of the kinds of chips we need. There is certain R&D that needs to be done. But as I mentioned in my remarks, we do not see this as a Defense only problem nor do we see Defense being able to solve the problem by itself.

The reason, as you have noticed in the report, that we are in the current situation is that as the sales have gone offshore, our international competitors are investing more of the percent of sales in R&D and capital. Therefore they are investing in the future and the long term more aggressively than we are capable of doing.

Now, when the sales go offshore, not only is the percent of the market that supplies their long term investment and their capability for the future increasing, but also since they have more dollars, the magnitude of their investment is more significant.

Senator LEAHY. I am still not sure I understand. Are you saying that the Administration does not plan to have a consortium funded by the Defense Department as the sole supplier of the Defense Department's needs?

Dr. KERBER. What I am saying is that we have considered this recommendation and have not determined what we are going to do at this time. We have to get with Commerce the Department of Energy. Also, we have to get with the National Science Foundation and come up with a strategy that is broader than Defense. That strategy may include the recommendation of a Sematech.

Senator LEAHY. In your testimony, you say that the Defense Science Board has made specific recommendations supporting the establishment of a semiconductor manufacturing technology institute, called Sematech, establishing standards of excellence, providing discretionary R&D funds, and so on. And you say that these proposals are going to require $400 million to $500 million per

year. Where is that money going to come from? It will not be added to the Defense Departments budget. The Appropriations Committee, on which I also serve, will not give an additional $400 to $500 million to defense. What programs will that come out of?

Dr. KERBER. As I mentioned to you, the Department has not made a decision on how to implement the recommendations of the Defense Science Board.

Senator LEAHY. I understand. You talked about making that decision within 60 days, but, there is presently a supplemental budget request before the Appropriations Committee from the Department of Defense. More are expected. Does the Department now intend or lean toward asking for $400 to $500 million additional or are they looking for other areas of the Departments' budget to take that money out of?

Dr. KERBER. The problem is that we have the study in front of us and we have not as yet decided how to deal with the recommendations. We think we need to deal with them in an aggressive way, but we have not established a plan. We will in the next 60 days.

Senator LEAHY. As you are doing that, for what it is worth—and there are 99 others in the Senate who may give you different views—but as one who serves on the Appropriations Committee and more specifically on the Defense Appropriations Subcommittee where the money is coming from, I would strongly suggest you look at areas where that money could come from. Rather than for that extra $400 to $500 million, I would urge DOD to give us a pretty good idea as to areas from which funding for a consortium could come from.

DOD is already looking for extra money to try to make the B-1 bomber fly, for example, which is certainly a commendable pursuit because we do not want to have to ship our airplanes by sea. I realize that the Flying Edsel is not in your department, Doctor, but the semiconductor chip is an important part of all our weapons systems. There is no question that as weapons systems develop the semiconductor chip will be an integral product to be considered.

I hope that, one, the Department takes the idea of a consortium very seriously, and I expect it will. But secondly, that they take it seriously enough to look for the kind of funding programs that really will work, that really have a chance at getting through, so we do not have an idea that dies aborning.

How much discussion is centered on how to organize a government private industry arrangement which would allow us to meet our Defense needs, maintain commercial self-sufficiency, and at the same time compete in the world market, so that it does not become a protected inefficient industry that simply is sort of a captive industry of the Department of Defense—one which would lack the kind of competitive efforts that the semiconductor industry needs in order to be efficient? Do you understand my question?

Dr. KERBER. I do.

Senator LEAHY. How do you approach that? You must have given some thought to that dilemma?

Dr. KERBER. We have had extensive discussions with industry leaders in the semiconductor technology area. We have not sorted it all out, but the proposal from the Defense Science Board basically would end up manufacturing a DRAM, which is a highly com-

petitive part of the semiconductor industry. We are at least in sympathy with that part of the study. We need to develop technologies for processing that will enable us to manufacture, in a very high volume way, very good quality semiconductors.

In fact, we are thinking about two and three generations of semiconductor technology that we need to develop. We also think that the industry, somehow, has to support it in a very aggressive way in the way. So the question of, when you look at the $400 or $500 million, how much of that should be in the Department of Defense budget and how much should industry cover—these questions are currently being discussed.

Senator LEAHY. I have been very interested in the question and have worked on legislation regarding this question of how to allow cooperative ventures. We make exceptions, if need be, to antitrust legislation, which was developed in a different era and which took into consideration a different type of manufacturing. Are you going to be proposing legislation that would permit cooperation between some of the industries for the development of manufacturing technology?

Dr. KERBER. We are working with Commerce to see at what needs to be done in order to, if you will, level the playing field for them to work together in some kind of semiconductor technology way.

Senator LEAHY. When you are dealing with these questions, you may want to suggest to members of the industry, that one strategy which could help American companies to be more competitive with the Japanese and others is to look not at next quarter's earnings but to look instead at long-range solutions, the way the Japanese do.

Incidentally, you mentioned DRAMs. What percentage of the U.S. industrial output in semiconductor chips do DRAMs represent?

Dr. KERBER. DRAMs are not as much a significant part of the output as a technologically stressing part of the output because they are a very competitive part of the market. You might have noticed in the study that the DRAM market was essentially 100 percent U.S. in the early 1970s. Now we are down at the 5- or 10-percent level in that area. This is the one area that requires us to develop technologies that are quite stressing and keeps us at the forefront in feature size and computing power that we need for our other systems. So that is the reason the DRAM was the one that they suggested. It is the one that the U.S. has lost a significant part of the market, essentially most of it, to international competition.

Senator LEAHY. I mentioned the intellectual property issues involved here. We got into this area for the first time in 100 years, and have created a new kind of intellectual property. I am sure there are a lot of people out there who are probably interested in the issue of intellectual property rights. I saw a couple of heads come up. I think they anticipated the question. Who has the proprietary rights to the intellectual property that would be developed by a manufacturing consortium that receives most of its funding from the Department of Defense? Who gets the patents, the copyrights, the trade secrets?

Dr. KERBER. In that case, the recommendation is that Defense would—the government would have rights to those technologies, and of course that consortium and whoever has ownership of the consortium, would also have rights to that technology.

Senator LEAHY. Would they have the rights to license foreign competitors, to manufacture whatever is created out of this consortium?

Dr. KERBER. I do not think we have considered that but it does not seem to me, on the first cut, that that would be in our best interest.

Senator LEAHY. I share your concern, and I have discussed this with Secretary Weinberger, our dependence on foreign supplies of semiconductors used in weapons systems. This is just a philosophical question. Was our dependence an inevitable result of the world competitive market or is our dependence due to a lack of leadership and support from the federal government?

Dr. KERBER. I think you are asking me to speculate on something that is difficult to speculate on.

Senator LEAHY. You have to ask that question because the answer to that is going to certainly affect what you do in the future.

Dr. KERBER. Precisely, and the Defense Science Board study pointed out that there are fundamental differences between the infrastructure in U.S. industry and in the industry, in this case, of Japan. We are now looking not only at what we need in Defense, but also at things that are broader than Defense. The industry is, as I pointed out to you, much more affected by the commercial market than it is by Defense.

The infrastructure in the Japanese industry is very different from ours. We do not feel, at least I do not feel, that we should or could duplicate that infrastructure. We have a different society and a different outlook. We need to decide what we need in this country and develop a strategy, if you will, which would help our industry help itself but which would not be a crutch to that industry.

Senator LEAHY. I notice that the Defense Science Board report focused on memory chips rather than logic chips. It is my understanding that the American industry is in better shape in the area of logic chips. Is the report flawed by its emphasis on memory rather than logic chips? Are logic chips less important to the Defense industry?

Dr. KERBER. I do not think they are less important but, for exampie, I think in the memory chip area, we are looking at things that are critically sensitive to the Department of Defense. For example, all the Cray supercomputer memory chips are manufactured in Japan. I think our dependence on computing capability and memory is very significant in smart munitions; in our capability to do fast real time analysis; in developing very efficient weapons system; even in flight control and very simple things. It is really critical that we have that leading edge technology in this country because we are putting so much of our emphasis on technological superiority for our defense posture.

Senator LEAHY. So have memory chips become more important to the defense industry?

Dr. KERBER. It is very important. I am not saying that the logic chip is not important, but a memory capability and the ability to do high speed computing is extremely important to us.

Senator LEAHY. Doctor, I appreciate your testimony very much. I have, and this is now where your staff will start groaning, I have a number of questions for the record that I would like to submit to you. I will also keep the record open for the rest of the week, if any of the other members of the committee have questions for the record.

[The following material was subsequently supplied for the record:]

SEMICONDUCTOR DEPENDENCY

QUESTION. Some commentators have argued that if the Pentagon contributes to a manufacturers' consortium, that it will want to exercise some control over the operation and that that control would divert the consortium from its announced purpose - support for commercial manufacturing. Dr. Kerber, if the Defense Department becomes involved in this consortium, what types of strings would it attach to its partners?

ANSWER. The Defense Department has no intention of exercising control over the operation of private industry. If the Department becomes involved with a consortium, it will attach no strings other than those legally required by current Defense and Federal Acquisition Regulations.

QUESTION. Dr. Kerber, has the Defense Department evaluated what controls it would impose over the products developed and produced by the manufacturing facility recommended in the Defense Science Board report?

ANSWER. The Department of Defense does not control products developed for private sector use. If any products of this facility were developed expressly for the military, they would fall under existing DoD security programs. Commercial products could be subject to non DoD export control policies.

QUESTION. Has the Defense Department considered alternative or additional mechanisms to direct funding which would result in fewer or less stringent controls over the chips produced by the recommended manufacturing facility?

ANSWER. The Defense Department is currently reviewing alternative funding approaches but has not yet reached any conclusions.

QUESTION. Would it be possible for the manufacturing facility to license technologies and use the royalties therefrom to fund additional research and manufacturing?

ANSWER. If such a manufacturing facility were established, it would be done in the private sector. The consortium would necessarily have to abide by the legal restrictions placed on this type of business. License agreements and royalties would in all likelihood be appropriate.

QUESTION. Two of the President's major objectives are a self-sufficient military and a business environment free from government interference. Does the Task Force's recommendations force the Administration to choose between building a strong, self-sufficient military and keeping the federal government out of direct participation in private industry?

ANSWER. The federal government, and particularly the Defense Department, has traditionally supported the development and maintenance of the technology base required for meeting national security needs. The DSB proposal entails no direct involvement in private industry outside of the normal contractual arrangements for research, development, and products related to DoD needs.

QUESTION. What is to be the role of government in the semiconductor initiative you have described? How deeply into planning, research and development, marketing and management is the government prepared to go to revitalize the semiconductor industry?

ANSWER. The Defense Department believes that the industry must assume the major role in resolving its own problems. Accordingly, we are following what the industry-created SEMATECH organization is planning. DoD is not directly involved in or trying to influence this process or its ultimate outcome. The DoD has a direct role and responsibility in assuring access to technology. Toward that purpose, DoD has a specific role in research and development, including that related to efficient production technology. However, we are not involved in any aspects of the marketing or management of the semiconductor industry initiative and we do not believe the government should be.

QUESTION. Have there been any instances since World War II when manufacturers based in countries with which we are allied have cutoff supply to our military or military contractors? You know, the Defense Department has a good reputation for paying its bills no matter what the cost. Why would the highly skilled, profit-oriented businesses described in the Task Force report cutoff a very good customer?

ANSWER. During peacetime, we do not foresee circumstances which would result in the cutoff of manufactured products. However, the situation of the U.S. being dependent upon foreign technology critical to its defense is a new and emerging phenomena and not one for which we have prior experience. Thus, examples of the type raised are few. Some other considerations are: (1) If the foreign country controls the market, they can control prices which may result in higher defense systems cost. (2) Our defense posture depends upon technological superiority to offset numerical superiority of potential adversaries and this superiority depends to a large extent upon electronics. If a foreign country possesses the best technology and chooses to sell this technology on the world market then the basis for our defense posture becomes diminished. (3) A foreign country possessing superior semiconductor technology and desiring to capture more of the electronics market, as we enter the information age, may intentionally delay delivery of the latest semiconductors so their domestic system builders will have a time advantage over competitors. Hence, the Department of Defense will not have access to the latest leading edge technology. This may lead to further dependence in such areas as telecommunications and supercomputers. (4) We have reached the point where entire electronic systems can be placed on a single or sometimes several chips. System operational and test characteristics, many of which are classified for military systems, must be divulged to the chip designers. The increase in transfer of classified information along with the potential unwillingness of foreign companies to accept classified work based on either moral or economic grounds concerns us. In times of war, foreign dependence may force us into certain military strategies which may be difficult and/or costly to carry out and may result in the reduction of military options.

QUESTION. Will the Pentagon's needs be met if U.S. companies form links with their Japanese counterparts? For example, would more agreements like the one recently announced by Motorola and Toshiba help solve the Pentagon's problems? Is this a way to reduce the direct role of the government in industry? At the same time, how would this approach resolve the problem of dependence on foreign technology and foreign sources for chips?

ANSWER. The needs of the Defense Department will be met if we can domestically procure the best semiconductors in the world for

use in our weapon systems. Company links between the U.S. and Japan concern us only if semiconductor technology and manufacturing leadership shift to Japan as a result of the link. This approach would help to resolve the problem of foreign dependency only if it resulted in the strengthening of U.S. technology and manufacturing capability.

QUESTION. Is a partnership between DoD and a private industry like the semiconductor industry a dangerous relationship for DoD to cultivate? Would the Department want to find itself with significant commitments to several major American industries? Is the sad truth that our national defense is destined to remain dependent on foreign manufacturers from now on?

ANSWER. The DoD and private industry are not mutually exclusive entities. We depend upon each other to a great extent. The DoD and private industry must both make commitments that will result in a strong industrial base and a military capability second to none. Our national defense is not dependent now upon foreign manufacturers and must not become dependent in the future. The DSB Task Force determined that, if actions are not taken now, we will become highly dependent in the future. Cooperative government-industry actions taken now may at some time in the future be looked upon in retrospect as a turning point in the history of our nation.

QUESTION. Dr. Kerber, in your written testimony you note that one of the Defense Science Board Task Force on Semiconductor Dependency's recommendations was to support the establishment of a semiconductor manufacturing technology institute. According to the March 5, 1987 Washington Post, the semiconductor industry has decided to orient their new consortium toward the refinement of technology rather than toward the manufacturing of specific products. Is such an orientation acceptable to the Department of Defense? Will that meet the Defense Department's needs as specified in the DSB Task Force report? Will the Department of Defense try to encourage the Semiconductor Industry Association to establish a consortium oriented toward the manufacturing of specific goods?

ANSWER. Our understanding of the current Semiconductor Industry Association plans are that they will pursue the development of a world class manufacturing capability. They will focus on the design, process, assembly and test of semiconductors needed to fabricate a variety of products. The technologies developed will be transferred to the semiconductor industry where they can be used to make specific products for sale to the commercial, industrial, and military markets. The Department of Defnese needs will be met when we can procure the best semiconductors in the world from the U.S. semiconductor industry. Since the SEMATECH organization is just being formed, it is too early to say whether it will satisfy all of DoD's needs. The Department will not try to influcence the consortium toward the manufacturing of specific goods.

Senator Humphrey. Concerning the report of the Defense Science Board Task Force on Defense Semiconductor Dependency, if the present trend in the deteriorating competitiveness of U.S. semiconductor production capacity continues, how soon will it be before our defense systems become dangerously overdependent on foreign supply of semiconductors?

Dr. Kerber. We expect that point will be reached in about five years.

Senator Humphrey. The DSB report says that the extent of this foreign dependence, at present, is "modest". Can you identify those

defense areas, if any, where we are already dependent on foreign-produced semiconductors for important defense systems or technology?

Dr. Kerber. A number of systems were found to contain semiconductors available only from foreign-owned, foreign-located sources. These systems are: GPS, IUS, DSCS, DSP, DMSP, FLTSATCOM, ASAT, ASN-10, F-16, AIM-7, SSQ AN-53B, AN/APG-63, HP, M1 Tank, AHIP, AN/ARC-182, AN/PRC-119, AN/ASN-92, AN/AYK-14, AM-6988 A FOET, F-18. In addition, many domestic semiconductors used in military systems are packaged and tested in foreign countries and ceramic packages are available almost exclusively from Japan.

Senator Humphrey. Other than Japan, what countries would we have to turn to for DoD semiconductor supply if we lose adequate domestic capacity?

Dr. Kerber. There is no other country to turn to that will assure us access to the best technology available. However, other countries such as Great Britain, France, West Germany, Italy and South Korea all possess an active semiconductor industry.

Senator Humphrey. What are the precedents for the kind of government sponsored technology research institute or consortium proposed in the study? Have such projects been successful in the past?

Dr. Kerber. Over the last six years, programs such as the Fifth Generation Computer Project and VLSI Project in Japan, the Very High Speed Integrated Circuits Program (VHSIC) in the U.S., the Alvey Programme in the United Kingdom, the Filliere Electronique in France, and the European Strategic Programme for R&D in Information Technology (ESPRIT), have been initiated to accelerate progress in semiconductors combined with information technology. What is common to all is the linkage of government-funded and coordinated R&D programs to national competitiveness, primarily for trade, or in the case of VHSIC, for national security. These projects have in general been very successful in promoting technology developments for use by the private sector.

Senator Humphrey. How did the panel derive the estimated dollar figures for funding the SEMATECH institute concept, i.e., $250 million for initial capitalization and $200 million per year for 5 years? What do those numbers represent?

Dr. Kerber. The estimates are based on historical capitalization costs within the semiconductor industry for a state-of-the-art manufacturing facility of the type discussed in the DSB report. An industry rule of thumb is that annual operating costs are approximately equal to the initial capitalization cost of the facility. The numbers represent best engineering estimates by members of the DSB Task Force associated with the semiconductor manufacturing industry.

Senator Humphrey. Other than the possible need for an antitrust exemption, has the DSB Task Force identified specific impediments or problems of a legal nature that might be raised by the SEMATECH institute concept?

Dr. Kerber. The DSB Task Force has not identified any legal impediments or problems associated with SEMATECH.

Senator LEAHY. I appreciate your coming here. I hope your staff and mine can keep in touch as you continue on this. It is obviously of great importance, but again I make the same advice to the Department of Defense that was implicit in one of my questions. Do not look just to the next quarter report. Do not look just to the next Defense posture statement that the Secretary has to bring up to the Hill. Look to next year, the year beyond, two or three years beyond there, because whatever congressional support for this proposal that you might get is really going to be dependent on what the projections are for 4 years, 5 years, 6 years down the road.

Dr. KERBER. It was a pleasure to appear and I would say I am very much in sympathy with that, since my job is research and technology, which is concerned with forward-looking technology for the Department. So we are in sympathy on those comments.

Senator LEAHY. Thank you, Doctor.

Our next witnesses are Ralph Oman, the Register of Copyrights, Donald J. Quigg, the Commissioner of Patents and Trademarks, and William Milam, the Deputy Assistant Secretary of State.

STATEMENT OF HON. RALPH OMAN, REGISTER OF COPYRIGHTS; DONALD J. QUIGG, COMMISSIONER OF PATENTS AND TRADEMARKS; AND WILLIAM MILAM, DEPUTY ASSISTANT SECRETARY OF STATE

Senator LEAHY. None of you gentleman are unfamiliar with testifying up here and at least one of you is familiar with the process from both sides of the table. I would like to put your testimony in the record, and go now to some very specific questions.

Mr. Oman, you stated in your testimony that there are three possible avenues to secure protection under the U.S. Chip Law: by treaty, by Section 914 interim order, and by Section 902 presidential proclamation. Now the public's participation in each of these is quite different. Members of the public can use their Constitutional right to petition Congress. When we have a treaty up for consideration, the public can urge us, in the Senate at least, to advise and consent or not to advise and consent.

Under the Secretary of Commerce's consideration of a Section 914 interim order, the public can comment on a given proposal. But in a presidential proclamation, unless the White House exercises a particular discretion, there is really no public input into consideration of a presidential proclamation.

Now, diplomatic negotiations, as you point out, are very delicate. Many of us have been there when they have discussed treaties, or negotiated them. I do not suggest that we should bring in large groups to participate in such negotiations. The high level negotiations that relate to a presidential proclamation are not going to be covered by C-SPAN or involve a call in panel. But do not the President's negotiators benefit if they at least receive a report from the industries that are going to have to live with the results of that proclamation?

Mr. OMAN. Mr. Chairman, I think that under the current law, the State Department could engage in informal consultations with the private sector prior to issuing a presidential proclamation. In my experience, granted limited, I have not heard complaints from

the private sector, that they have proceeded without full and adequate consultation.

I assume that the State Department would also consult if there were a question that arose under microchips. If serious doubts do exist about a foreign country's protection of American chips, I venture that the State Department will find out about it without a full blown public hearing, but of course if the State Department does have any doubts it can, as I say, under current law informally convene public hearings and call witnesses and get the information it needs.

I venture, also, that this really is not a direct concern of the Copyright Office and I am only a little dog barking at the tires of the two Cadillacs on my right.

Senator LEAHY. Yes, but look at all the experience you have had up here. Actually, sometimes a little bit of public comment helps. Mr. Quigg is probably thinking of one example where that happened back in 1985 regarding a discussion with the U.K. I realize we are getting into a somewhat different track, but the fact that people started hollering about the U.K.'s application was helpful, was it not?

Mr. QUIGG. Yes, indeed.

Senator LEAHY. What I am trying to do is tread that line between where you have to be able to continue as we normally do in these things, but also when we are talking about a rapidly changing, highly competitive industry, where do you get the comments? We do not have all the expertise in government. We certainly do not here on the Hill. You do not. Mr. Oman talks about riding past the Cadillacs, meaning State and Commerce. But the Copyright Office does not have the total expertise in this area anymore than any one single industry does.

None of us could sit here today and predict precisely what areas we are going to be discussing or what the technology will be available in 5 years from now, ten years from now. So I am trying to figure out how we find the balance between being able to have the negotiations and having them come to a conclusion at some point. But also, how we encourage the kind of public comment that is going to be helpful to us in making the decisions.

In that area, Mr. Oman, you are familiar with the WIPO Treaty that is going to provide international protection for chip design. How does that stand now? How is that going? Give me a progress report.

Mr. OMAN. I wish I could be completely upbeat, Mr. Chairman. We have consulted every step of the way, in this regard, with the private sector and we have made some progress. But I think it is fair to say that we still have some important differences, even among the industrialized countries, who would seem to have a very direct interest in negotiating a multilateral agreement to protect chips.

The differences are centered primarily on what definitions should be included in the treaty and second, the scope of reverse engineering. These details aside, I think it is fair to say that the treaty enjoys strong support among the industrialized countries in principle.

Senator LEAHY. Are they trying to make the scope more extensive than what we find in U.S. law?

Mr. OMAN. No, as a matter of fact, what we are trying to do is develop a treaty that is entirely consistent with U.S. law. There are those who are urging higher forms of protection that would make U.S. law incompatible with the treaty, and we are trying to resist those efforts also.

Senator LEAHY. Some have questioned whether layout designs should be included in the treaty, but this was not addressed in the 1984 Act. Is that one of the pressures?

Mr. OMAN. That is one of the areas that we are in the process of negotiating with our trading partners—definitions. I think the United States could probably live with the more general definition of layout designs without the specific mention of semiconductor chips, but we are trying to do what we can to avoid the necessity of enacting implementing legislation if a treaty is eventually agreed to.

The big problem is coming from the developing countries. They see no direct interest in their own on moving forward with a treaty, and it is up to us to convince them that it is very much in their own interest, in terms of technology transfer, and in terms of investment within their countries, that they give adequate protection to U.S. and other semiconductor chips as a way of encouraging the industrial development they need.

Senator LEAHY. You mean Singapore is not leading the charge to get this treaty through?

Mr. OMAN. They are not out there in front, you are right, leading the charge, but they are not one of the problem countries, either. The countries that have been giving us the most difficulty, in terms of being able to convince them this is in their own interest, are countries like India and Brazil, countries that expect to develop microchip industries of their own.

Senator LEAHY. What is the state of the microchip industry in India and Brazil?

Mr. OMAN. They are fledgling industries, but they have high hopes for the future, as a way of solving their overwhelming problems of large populations and economic pressure.

Senator LEAHY. Let me ask you another question. Based on your experience in the field of intellectual property protection, if the Defense Department were to supply partial funding for a coordinated manufacturing effort by the semiconductor industry, who owns the intellectual property rights?

Mr. OMAN. The general rule of thumb in the copyright area is that the government cannot own copyrights. I would defer to Commissioner Quigg on the question of patents. I know the Senate Judiciary Committee, in the past few years, has gotten into the business of insisting that the government share its technology with the private sector. If it is not exploited commercially within a certain number of years, then the industry itself would have rights to market it commercially.

But in the national defense area, as the Assistant Secretary of Defense mentioned, this raises other questions, in terms of what is in our own national self-interest.

Senator LEAHY. You heard our earlier discussion of that. Are we going to need special legislation, if there is such a consortium, to determine who owns the intellectual property rights, or do you feel that the law, the way it now stands, makes it clear that the government would not be the owners?

Mr. OMAN. I think it depends, in some instances, on the contractors who actually wind up doing the work. Under the Small Business and University Patent Procedures Act, I think that there would be easier access to the marketing of the technology by the companies, if they are small businesses or universities. But if they are large businesses, I think there would be difficulties under the current law, since they do not fall within the ambit of that legislation.

Senator LEAHY. Thank you. You, too, will be asked to answer follow-up questions. And again, the record will be kept open for the rest of the week so that the other members of the subcommittee may submit written questions, as well.

[Prepared statement and response to written questions follow:]

Statement of Ralph Oman
Register of Copyrights
Assistant Librarian for Copyright Services

Before the Subcommittee on Technology and the Law
Senate Committee on the Judiciary
100th Congress, First Session
February 26, 1987

I am Ralph Oman, Register of Copyrights. Thank you for the opportunity to appear before your Subcommittee in its first hearing. The primary focus of the hearing is the proposal in S. 442 to extend a unique administrative authority, now scheduled by law to expire in November 1987, until November 1990. You have also asked me to comment on whether or not Congress should revisit the presidential proclamation provision of the Act, section 902. In this connection, I understand some people have suggested a public hearing procedure under section 902. They also raise questions about the President's authority to revoke a proclamation.

In addition to addressing these issues, I want to take this opportunity to review the Semiconductor Chip Protection Act of 1984, Public Law 98-620 (98 Stat. 3347), and report briefly on the efforts to create an international chip protection treaty and on the experience of the Copyright Office in administering the Chip Act.

Section 914 of the Semiconductor Chip Protection Act has no parallel in the intellectual property field. It provides an interim system of international protection for semiconductor chip designs until protection can be formalized under a multinational treaty or a presidential proclamation. The Secretary of Commerce is authorized to issue an order extending to nationals of a foreign country protection under the Semiconductor Chip Protection Act if a number of conditions are satisfied.

Under the present terms of the law, the Secretary's authority to issue section 914 orders ends on November 8, 1987. Senate Bill 442, 100th Cong. 1st Sess. (1987) would extend the authority of the Secretary of Commerce for three more years. I support passage of this legislation. While the United States and its trading partners have made some progress in negotiating a multilateral treaty, further work remains to be done. Based on the original justification for this exceptional procedure, Congress should extend the authority of the Secretary of Commerce for a few more years. During that time frame, I hope we can complete our work on the treaty, and ratify it. At that point, we will no longer need these transitional administrative procedures.

EXTENSION OF THE 914 ORDER AUTHORITY

For mask works first commercially exploited outside the United States and owned by foreign nationals,[1/] the Semiconductor Chip Protection Act essentially establishes three avenues to secure protection under the United States chip law: by treaty, by Presidential proclamation, and by section 914 orders. So far sixteen foreign nations have qualified for registration based on the issuance of section 914 orders. No presidential proclamation has issued. No existing treaty clearly protects mask works.

Under section 914, the Secretary of Commerce is authorized to issue an order extending to nationals of a foreign country protection under the Chip Act where three conditions are satisfied. The conditions are (1) that the foreign nation in question is making progress (either by treaty negotiation or legislative enactment) toward a regime of mask work protection generally similar to that under U.S. law; (2) that its nationals and persons controlled by them (such as subsidiaries or affliated companies) are not engaging and have not in the recent past engaged in chip piracy or the sale of products containing pirated semiconductor components; and (3) that entry of the Secretary's order would promote the purposes of the Act and of achieving international comity toward mask work protection.

The Commerce Department published guidelines for submitting a section 914 petition on November 7, 1984, in the Federal Register. (49 FR 44517 (1984)). In this notice the Secretary of Commerce delegated responsibilities under section 914 to the Commissioner of Patents and Trademarks.

Because the section 914 procedure was experimental, Congress directed the Secretary of Commerce, in consultation with the Register of

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1. Foreign nationals can get protection in the United States, without a section 914 order or treaty or proclamation, by first commercial exploitation of the mask work in the United States. Also, as discussed in reviewing the administrative experience, mask works owned by foreignors are registered if "all rights in the United States" are sold to a United States national.

Copyrights, to report in two years on the actions taken under section 914.2/ That report made a comprehensive summary of the actions taken under section 914, and I will not rehash the details already presented to the Congress.

During this transitional period between the creation of a new form of intellectual property protection in two countries (the United States and Japan) and development of a treaty, the section 914 procedure fosters protection of mask works and serves international comity. Section 914 was clearly intended as an interim means for extending protection to foreign nationals until more formal arrangements could be established. At some point a treaty, or a series of presidential proclamations, should be in place, thereby obviating the need for the section 914 procedure. However, that time is not now, and the Secretary's authority should be extended by enactment of S. 442.

SECTION 902 PRESIDENTIAL PROCLAMATION

Section 902 represents a second, more permanent, bilateral avenue for protection of foreign mask works. This presidential proclamation authority is patterned on section 104 of the Copyright Act. A proclamation provision has been part of the copyright laws since 1891.

As to the President's authority to revoke, revise, or suspend a proclamation where the statute is silent, the Copyright Office believes such authority is inherent in the foreign power authority of the President. However, if the Congress wishes to clarify the Chip Act in this respect, the Office would support that.

Regarding the question of a public hearing under Section 902, a public hearing has not been part of the presidential proclamation procedure under the copyright law. To make the presidential proclamation procedures of the Chip Act subject to public hearings would seemingly require statutory amendment. Whether such a policy would be advisable appears to turn on whether it is believed the State Department would learn significant new information through a public hearing procedure that it would not have learned otherwise, and must be balanced by concern about intrusion into

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2. Report on the Operation of the International Transitional Provisions of the Semiconductor Chip Protection Act of 1984, Submitted by The Assistant Secretary and Commissioner of Patents and Trademarks, In Consultation with the Register of Copyrights (November 7, 1986).

frequently delicate diplomatic negotiation on a government to government level.

In assessing the appropriateness of a copyright presidential proclamation, the State Department has always consulted widely with the United States private sector on an informal basis. I assume that consultation will occur regarding mask works. Moreover, in many cases, the State Department will also have access to the testimony given in the section 914 proceedings. If serious doubts exist concerning a foreign nation's protection of American semiconductor chip products, the Copyright Office believes the State Department will be well informed of the circumstances without resort to formal public hearing procedures.

STATUS OF THE WIPO DRAFT TREATY

The most advantageous form of international protection is membership in a multilateral convention. Bilateral arrangements, especially if they persist over decades, are cumbersome and lead to a patchwork quilt of rights world-wide, which are frequently subject to disparate procedures and formalities as a condition of rights. Pursuant to the goal of creating a new treaty, the World Intellectual Property Organization convened two meetings of a Committee of Experts (held in November 1985 and June 1986) to study a draft treaty for the protection of integrated circuit designs. I had the honor of serving as Head of the United States Delegation to those meetings. A third experts meeting is scheduled for the last week in April, 1987.

Although progress has been made in the first two meetings, differences in viewpoints between industrialized nations remain to be bridged. The two main points of concern among developed nations are the definitions in the treaty and the scope of permissible reverse engineering, as a limitation of the rights granted. Unless agreement can be reached on these issues, the treaty will elude us.

The treaty concept enjoys strong support among the industrialized nations. Those developing contries attending the meeting profess support for a treaty but many of them favor the inclusion of broad compulsory licensing provisions. Broad compulsory licensing is totally unacceptable to the United States, especially since the level of protection proposed in the treaty -- similar to the United States law -- is already modest.

The meeting of experts in April will tell us a great deal about the

chances for a treaty. Unless a consensus emerges, at least among the industrialized nations, convening a world diplomatic conference to adopt a new treaty would probably not be justified.

ADMINISTRATIVE EXPERIENCE UNDER THE SEMICONDUCTOR CHIP PROTECTION ACT OF 1984

Since this hearing represents the first congressional oversight of the Semiconductor Chip Protection Act since enactment, some comments about our experience in administering the Act seem appropriate.

The Semiconductor Chip Protection Act of 1984, Pub. L. 98-620, was signed into law by the President on November 8, 1984. The legislation protects mask works fixed in semiconductor chip products which meet the eligibility and originality requirements of the Act. Under section 908 of the Act, the Copyright Office is assigned the task of establishing a registration system for mask works.

In order to carry out its responsibilities, the Copyright Office held a public hearing on October 4, 1984, to secure information helpful to the preparation of regulations. (49 FR 39171). On January 3, 1985, the Copyright Office issued interim regulations implementing the Act. (50 FR 263). The regulations were made immediately effective since owners of mask works were entitled to file applications for registration on January 7, 1985.

Approximately simultaneously with publication in the Federal Register of the interim regulations, the Copyright Office issued Form MW and an information circular. A mask work examining unit was also formed within the Examining Division of the Copyright Office.

After careful consideration of the public comments, the Copyright Office published its final regulations on June 28, 1985, modifying the interim regulations in a number of areas. (50 FR 26714).

In 1985, the mask work unit of the Copyright Office received a total of 1880 applications for registration, and issued 1263 registrations. Of the total registrations, 717 were issued to American nationals, 481 to Japanese nationals, 39 to nationals of the U.K., and 26 to other eligible foreign nationals. Total claims refused registration in 1985 amounted to 139.

In 1986, the mask work unit received a total of 542 applications, and issued 859 registrations. The greater number of registrations versus

receipts is attributable to the working off of a backlog which had accumulated in 1985 because of the July 1, 1985 filing deadline. In order to qualify for retroactive protection for mask works commercially exploited between July 1, 1983 to November 8, 1984 registration had to be made by July 1, 1985.3/ Of the total registrations issued in 1986, 620 went to U.S. nationals, 179 to Japanese nationals, 20 to nationals of the U.K., and 40 to other foreign nationals. Total claims refused registration in 1986 were 26.

In implementing the Semiconductor Chip Protection Act, the Copyright Office discovered two areas of ambiguity. Section 902(a)(1) of the Act establishes as one of the criteria for eligibility that "the owner of the mask work is a national or domiciliary of the United States..." Section 901(a)(6) of the Act defines owner as the person to whom "all the rights under this chapter" are transferred. The Act is unclear whether "transfer of all rights" means all rights worldwide or only United States rights. The Copyright Office interim regulation took the position that all rights worldwide had to be transfered, rather than a transfer limited to United States rights. The Copyright Office reasoned that basing eligibility on a transfer limited to United States rights could significantly lower the incentive to secure section 914 orders.

This interpretation of the Copyright Office was criticized in three comment letters, and none supported the Office's interpretation. In issuing final regulations, the Copyright Office concluded there was doubt over the issue and adjusted the regulation to allow registration based on transfers limited to "all United States rights." The Copyright Office, however, remains concerned that allowing eligibility to be based on a transfer limited to United States rights may serve as a disincentive for foreign governments actively to seek section 914 orders. The Subcommittee may wish to clarify this point.

The second area of ambiguity concerns the effect of backdating a section 914 order on the statutory deadlines designated in the Act. Sections 908 and 913(d)(1) set clear statutory deadlines for the securing of protection. Under section 908(a) registration must be sought within two years of first commercial exploitation. Under section 913(d)(1) mask works first commercially exploited between July 1, 1983 and November 8, 1984, had

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3. Section 913 of the Act.

to be registered before July 1, 1985, in order to secure protection under the Act. While the July 1, 1985 deadline has passed, the ambiguity concerning the effect of a backdated section 914 order continues with respect to the two-year deadline from first commercial exploitation.

The Patent and Trademark Office ordinarily backdates orders to the date the petition was originally filed. What is the status of a mask work that is unregistered when the statutory filing deadline expires and no section 914 order has been issued? Under the interim regulation, the Copyright Office required that an order be issued before the statutory deadline in order for a mask work to be eligible for protection.

The Copyright Office received two public comments criticizing this position. Both argued that the time constraints placed on foreign governments to secure issuance of a section 914 Order posed a hardship in light of the complexities of the issue. In addition, both argued that the authority to issue backdated orders under section 914 was the most pertinent indication of Congressional intent.

The issue presented a dilemma for the Copyright Office. Under the interim regulation, some claims in chips associated with a foreign country whose mask works the Secretary of Commerce arguably deemed worthy of protection could have been denied registration. On the other hand, a policy of holding in abeyance foreign claims awaiting a section 914 order even after expiration of statutory deadlines also had serious drawbacks. Under such a policy, the certainty stemming from registration within the statutory deadlines is eliminated. In addition, a de facto form of protection would probably be extended for chips held in abeyance. Potential chip copiers could not risk infringement of unregistered chips since there would exist a possibility of protection under the Act even after expiration of the statutory deadline for registration. In circumstances where an order was never issued, this de facto protection would be achieved for an indefinite time period without securing eligibility under the Act.

Ultimately, the Copyright Office concluded that only a court could resolve the statutory conflict, without amendment of the law. In light of the Act's favorable stance towards establishment of international mask work protection, the Copyright Office issued final regulations allowing registration of claims received in the Office before the expiration of the statutory deadlines and subject to the possibility of a backdated section

914 order. Because of the Patent and Trademark Office's expeditious actions on section 914 petitions and cooperation between our two agencies, only a handful of registrations have been made after expiration of the statutory deadline. The Copyright Office, however, believes the validity of these registrations is in doubt, and recommends that the policy regarding the statutory deadlines in relation to the section 914 authority be clarified.

Thank you. I will be pleased to respond to your questions now or later for the record.

Semiconductor Chip Hearing

Senate Subcommittee on Technology and the Law

February 26, 1987

Answers to Written Questions

Question: Mr. Oman, we are all very interested in a progress report on the WIPO Treaty that would provide international protection for chip designs. Please specifically address what you refer to as the two main points of concern among developed nations. That is, the definitions in the treaty, and the scope of permissible reverse engineering.

Answer: With respect to the definitions the problems are two-fold: first what terms, if any, should be defined in the treaty and what meaning should be given the terms. For example, in the case of the words "integrated circuit" the United States prefers a definition that includes "semiconductor" as a modifier of "integrated circuit" because our law covers only mask works fixed in semiconductor material. Printed circuit boards are examples of integrated circuits that are outside of our law because they are not fixed in semiconductor material. Some countries want to omit the term "semiconductor" because they seek a treaty flexible enough to cover new technological developments.

The 1987 WIPO Draft Treaty defines "integrated circuit" without the "semiconductor" modifier. In the notes, however, it is stated that "it is understood that a country which only protects semiconductor integrated circuit layout-designs would comply with its obligations under the treaty." If this interpretation is accepted, the United States can probably agree to the elimination of the term "semiconductor."

In the case of reverse engineering the debate concerns the scope of that limitation on the exclusive rights. In the last meeting of experts, proposals were submitted from Japan, Australia, and the United Kingdom for reverse engineering language that appeared to constitute a narrower permissible limitation on exclusive rights than under present U.S. law. The United States Delegation has sought agreement on a permissible range of reverse engineering that encompasses both the United States concept as the broadest permitted limitation but also allows other countries to opt in national law for a less broad limitation of rights.

The 1987 WIPO draft retains the reverse engineering language of earlier drafts. The United States favors this approach.

Question: You state that the level of protection proposed in the treaty is similar to that in the U.S. law, but that it is modest. Is it your opinion that the level of protection for chip designs contained in the 1984 U.S. Semiconductor Chip Protection Act law is insufficient?

Answer: I have no evidence that the level of protection in the United States is too modest. I assume it is sufficient to encourage investment in chip design improvements. A broad consensus within the American semiconductor industry supported the level of protection established by the Semiconductor Chip Protection Act. There are no developments, of which I am aware, indicating that the level of protection was established too low. At the same time, the level of protection is modest and should not be reduced.

Question: Many people in the American Semiconductor Industry believe that a compulsory licensing provision should not be included in the WIPO treaty. Do you agree? Could you recommend to the Senate a Chip Treaty that contained a compulsory licensing provision?

Answer: I agree that a broad compulsory licensing provision should not be included in the WIPO treaty, and I would not recommend that the Senate ratify a treaty containing a broad compulsory licensing provision. Provisions similar to the innocent infringer and retroactive protection clauses of our law would be acceptable.

Question: It is my underderstanding that there is no mechanism for dispute resolution in the draft WIPO treaty. Is my understanding correct? Would the value of the treaty be diminished if it did not have a mechnaism for dispute resolution?

Answer: There is no specific mechanism for dispute resolution, but the draft treaty proposes establishment of an Assembly to deal generally with issues that may arise concerning the treaty. All member states would be part of the Assembly. Proposed Article 7(2) provides the Assembly "shall deal with matters concerning the application and operation of this treaty." The United States has voiced support for the Assembly concept.

In the second meeting of experts, the United States submitted a document proposing specific consultation procedures. A few developed countries expressed support, while most appeared to have reservations.

The third WIPO draft does not include a specific mechanism for dispute resolution, but the United States proposal is part of the documentation for the meeting. We will continue to press for specific consultation procedures, but we do not yet have the support even of our trading partners. The Assembly mechanism opens the door for future agreement.

Question: If a treaty were adopted without a mechanism for settling disputes, what process would be used to assess an allegation that a signatory nation's law did not embody the principles of the treaty? What process would be used to settle such a dispute?

Answer: The issue would have to be taken up in the Assembly. Clearly, we would prefer more specific procedures to settle disputes, and we will continue to press forward on the issue. Addressing the issue in the Assembly, however, may be the only action other nations will agree to.

Question: What will be the relationship between the intellectual property conventions that have been or will be developed by WIPO and those standards governing intellectual property that may be developed through future rounds of GATT?

Answer: If the United States becomes a party to a WIPO treaty protecting layout-designs of integrated circuits, we would be bound by the terms of that treaty. It is unclear at present what standards, if any, governing intellectual property might emerge from future rounds of GATT. I would assume that nations negotiating standards for GATT would be cognizant of the international standards fostered by the multilateral intellectual property conventions. I would expect that the the two international forums would be complementary. I do not believe that it will be any easier to reach agreement on international norms in the GATT-trade context than it is at meetings of intellectual property experts. Since GATT is not a treaty, its rules or norms do not have the same legal effect as the obligations of an intellectual property treaty. The latter is primarily a vehicle for establishing property rights enforceable by citizens who hold the rights; the GATT is an intergovernmental forum for trade negotiations.

Senator LEAHY. I want to thank you for your help and for the cooperation of your office to begin with, but I suspect we are going to have to be calling on you a number of times between now and the time we finish this legislation, in determining just where we go.

Mr. Quigg, I note a couple of years ago the President signed an executive order authorizing the Commerce Department to work with the State Department to advise regulations governing Section 902 proclamations. Has the Secretary of Commerce promulgated regulations governing 902 applications?

Mr. QUIGG. Not 902 regulations, no, sir.

Senator LEAHY. I always assumed when the President—he probably does too—signs an executive order, he feels it is going to be followed out. That was 2 years ago.

Mr. QUIGG. At the present time, most of our activity has been in the area of section 914. We have been trying to watch that, and discuss that particular situation thoroughly with the private sector. We have identified problems that have arisen, such as one that arose in Japan, where it looked like there were going to be delays for applications from the United States. We took steps to communicate with the Japanese embassy and almost immediately that problem disappeared.

So at the present time we have focused our attention on section 914, waiting for developments. I think that in regard to Japan we are in position where, according to the information we have, the Japanese have met the requirements of 914 in probably both respects, national treatment as well as protection corresponding to our own law. So soon we must consider a Presidential proclamation under 902.

Senator LEAHY. I would hope so because you know otherwise there is always the temptation up here for us to write the regulations ourselves in the form of legislation. Now you have all that flexibility downtown and I would suggest—I certainly do not want to tell you how to do your business—but I would suggest when you get back down there to the Department, you might mention to them that they may want to dust that off and get hustling a little bit so they do not have to have some small town lawyer from Vermont write the regulations into legislation.

Mr. QUIGG. Since those regulations will originate with us, we will do that.

Senator LEAHY. Do you think you might issue regulations before you consider a 902 application from Japan?

Mr. QUIGG. I think so.

Senator LEAHY. Good, I would hope so. I would strongly urge it. In your written testimony you emphasize the public proceedings under 914 have clearly demonstrated the usefulness of an open process. In a government report from you and Mr. Oman, it was noted that the information gathered during that public process, along with consultations with representatives of some of the concerned U.S. rights holders, that is going to be invaluable in the discussions on the establishment of permanent relations to a presidential proclamation.

Does that mean that you intend to incorporate into your regulations in Section 902 an opportunity for public comment?

Mr. QUIGG. I think, in view of our experience not only with section 914 but a number of other rule changes and the like in the Patent and Trademark Office, we have not found a great deal of additional information comes in by an open hearing over what we get from communications from various areas of the private sector.

Senator LEAHY. Is that a yes or a no?

Mr. QUIGG. My recommendation would be no as to a public hearing, but if this committee feels that it is desirable, we would certainly not object to it.

Senator LEAHY. Again, you folks have far more expertise in this area than I, but I would think that when we are dealing with such a rapidly changing area of technology, that some room for public comment cannot hurt. I do not mean a process which would cause us to spend the next several years just listening to comments and not ever getting anything done.

Obviously, we should institute some regulations, but even in preparation for these hearings, as we start talking with the industry as McC. Mathias and I did in the last several years, we find such a wealth of experience and knowledge out there in the industry and not everyone agrees with each other by any means. In such a rapidly changing area of technology we should take these differing views into consideration.

It certainly is something to keep in mind, something worth thinking about.

Mr. QUIGG. Mr. Chairman, if I might interject there, I certainly would feel that a notice should be published of our intention to move it forward. As far as dealing with the private sector is concerned, that is one of our major commitments in the Patent and Trademark Office. With the public, my door is open anytime. Anyone that wants to walk in. And we seek out various areas of industry where we know that there are differing views; we try to get them all in and evaluate them before we do anything.

Senator LEAHY. I did not want to suggest otherwise. I know you do and I appreciate that. I think that an office functions best when it does that.

Mr. QUIGG. Yes, indeed.

Senator LEAHY. I talked earlier, in my opening statement, about what we are going to do with the Secretary. Are we going to give him an indefinite extension to be able to issue orders under 914 or grant protection under 914? Should we say, however, that he is going to be limited in the amount of protection he can offer?

There is a certain amount of debate that goes along with these questions and I am sure that we will be discussing the issue in this committee before we are done. One possible area of compromise is to say to the Secretary, "Okay you have the authority". We are not going to cutoff time on that authority under Section 914 and instead simply say that is a permanent part of the Secretary's authority.

But he cannot grant the protection for more than five years on the basis that this forces the Department, after 4 years or so to sit back, look at the situation, and determine if protection should be continued. It also keeps a little leverage on countries which are not following through on agreements made when we granted them protection. It forces everybody to go back and look at it again.

What do you think of that idea? The indefinite authority of the Secretary, while prohibiting him from granting to any one country protection for more than 5 years.

Mr. QUIGG. I think it is a good approach. Whether five years is a limit, that really does not make too much difference, I think, in view of 914(d)(1)(a), which gives the Secretary the right to withdraw protection if the situation changes. I am certain that the private industry is going to be in telling us the situation has changed. And if it has, we will set a hearing and determine whether or not it should be withdrawn. Whether five years is necessary, I do not know.

Senator LEAHY. Of course, those countries might also go try to do an end run and seek a Presidential proclamation under 902.

Mr. QUIGG. I think they are going to have to go through us, first.

Senator LEAHY. Like the others, I have a number of questions for the record.

[Prepared statement and response to questions follow:]

SUMMARY
STATEMENT
OF
DONALD J. QUIGG
ASSISTANT SECRETARY AND COMMISSIONER
OF PATENTS AND TRADEMARKS

ON S. 442

A BILL TO AMEND TITLE 17, UNITED STATES CODE

BEFORE THE

SUBCOMMITTEE ON TECHNOLOGY AND THE LAW
SENATE COMMITTEE ON THE JUDICIARY

FEBRUARY 26, 1987

Mr. Chairman and Members of the Subcommittee: Thank you for this opportunity to appear before you to testify on S. 442, a bill to amend section 914 of title 17 United States Code.

The developments during the past two years have pointed out the inherent balance of the SCPA. It balances not only the exclusive rights of mask work owners and the public interest in the broad dissemination of the fruits of research and development, but also domestic and international interests. Congress sought to foster the development of international comity in mask works protection through the operation of section 914, and our experience thus far suggests that it has been successful.

S. 442 would extend the authority of the Secretary to issue interim orders until November 8, 1990. We believe that the extension should be for an indefinite period beyond 1990. Consequently, the Administration endorses a proposal to extend indefinitely the Secretary's authority to issue interim protection orders. This process has proved to be an effective tool in promoting international comity in the protection of mask works and we believe its extension would further serve the interests of the United States.

STATEMENT OF
DONALD J. QUIGG
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Mr. Chairman and Members of the Subcommittee: Thank you for this opportunity to appear before you to testify on S. 442, a bill to amend section 914 of title 17 United States Code.

The Semiconductor Chip Protection Act of 1984 (SCPA) established a new form of intellectual property protection for mask works or semiconductor chip layout designs fixed in semiconductor chip products. The new subject matter of protection, mask works, is defined in 17 U.S.C. §901(a)(2) as:

> a series of related images, however, fixed or encoded
>
> (A) having or representing the predetermined, three dimensional pattern of metallic, insulating or semiconductor material present or removed from the layers of a semiconductor chip product; and
>
> (B) in which series the relation of the images to one another is that each image has the pattern of the surface of one form of the semiconductor chip product.

The SCPA provides for a 10-year term of protection for original mask works, measured from the earlier of their date of registration in the U.S. Copyright Office, or their first commercial exploitation anywhere in the world. Mask works must be registered within two years of their first commercial exploitation to maintain this protection. Section 913(d)(1) provides that mask works first commercially exploited on or after July 1,

1983, were eligible for protection provided that they were registered in the U.S. Copyright Office before July 1, 1985.

Foreign mask works are eligible for protection under the criteria set out in section 902. First, the owner of the mask works must be a national, domiciliary, or sovereign authority of a foreign nation that is a party to a treaty, that provides for the protection of a mask work and to which the United States is also a party, or a stateless person wherever domiciled. Second, the mask work must be first commercially exploited in the United States; or it must come within the scope of a Presidential proclamation. Section 902(a)(2) provides that the President may issue such a proclamation upon a finding that:

> a foreign nation extends to mask works of owners who are nationals or domiciliaries of the United States protection (A) on substantially the same basis as that on which the foreign nation extends protection to mask works of its own nationals and domiciliaries and mask works first commercially exploited in that nation, or (B) on substantially the same basis as provided under this chapter, the President may by proclamation extend protection under this chapter to mask works (i) of owners who are, on the date on which the mask works are registered under section 908, or the date on which the mask works are first commercially exploited anywhere in the world, whichever occurs first, nationals, domiciliaries, or sovereign authorities of that nation, or (ii) which are first commercially exploited in that nation.

To encourage development of a regime of international comity in mask work protection, section 914(a) permits the Secretary of Commerce to extend the privilege of obtaining interim protection under chapter 9 to nationals, domiciliaries and sovereign authorities of foreign nations if the Secretary finds:

> (1) that the foreign nation is making good faith efforts and reasonable progress toward
>
> > (A) entering into a treaty described in section 902(a)(1)(A), or
> >
> > (B) enacting legislation that would be in compliance with subparagraph (A) or (B) of section 902(a)(2); and

> (2) that the nationals, domiciliaries, and sovereign authorities of the foreign nation, and persons controlled by them, are not engaged in the misappropriation, or unauthorized distribution or commercial exploitation of mask works; and
>
> (3) that issuing the order would promote the purposes of this chapter and international comity with respect to the protection of mask works.

While section 914 is silent on the specific procedures to be followed in making the requisite determinations and issuing the interim orders, the legislative history of the SCPA makes it abundantly clear that Congress intended a process of public notice and hearing to be followed. On November 7, 1984, the Patent and Trademark Office issued "Guidelines for the Submission of Applications for Interim Protection of Mask Works under 17 U.S.C. §914" along the lines suggested in the report. These guidelines specified the content and procedures for the submission of petitions for the issuance or termination of interim orders; define who is eligible to submit applications to initiate proceedings; the procedures to be followed by the Office; and the information required to be submitted. It is important to note that while a petition for an interim order may be submitted by anyone, the Commissioner's findings must be made in respect to the actions of a government. Consequently, the Guidelines require that certain information be supplied by the foreign government in question. They also encourage the submission of additional material by the applicant that would aid in making the determinations.

Procedurally, the Guidelines require the Commissioner to receive petitions and to initiate proceedings to grant or revoke interim orders. The Commissioner may upon his motion, or upon the direction of the Secretary, initiate proceedings. The first step is to publish the petition in the Federal Register to solicit comments. Afterwards, the Commissioner may determine to hold a public hearing. Following these procedures, interim orders have been issued for the 12 member States of the European Community, Japan, Sweden, Canada and Australia. We are now in the process of conducting a review of a petition from Switzerland.

The developments during the past two years have pointed out the inherent balance of the SCPA. It balances not only the exclusive rights of mask work owners and the public interest in the broad dissemination of the fruits of research and development, but also domestic and international interests. Congress sought to foster the

development of international comity in mask works protection through the operation of section 914, and our experience thus far suggests that it has been successful. The issues that Senator Leahy has identified derive from the relationship between the permanent international provisions of section 902 and the international transitional provisions of section 914.

Section 902 sets out, in a manner similar to section 104 of the Copyright Law, the criteria upon which foreign mask works will be eligible for protection in the United States. The controversy over substantive criteria for the eligibility of foreign works for protection has centered around the process and criteria for the issuance of a Presidential proclamation under section 902(a)(2).

Our view is that the plain language of section 902 and its legislative history suggest two very different means for achieving eligibility. The foreign country must provide some protection, either with a law that gives substantially the same protection as the SCPA, or with a law that protects mask works and gives U.S. nationals and domiciliaries national treatment. Such protection can be provided either by a sui generis law or under the country's patent or copyright legislation. In either case, the President may issue a proclamation for that country.

The fundamental question to be answered in determining eligibility of a foreign nation is independent of whether that nation enacts a sui generis law that is substantially similar to the SCPA or provides national treatment under a system within their patent or copyright law. The real issue is whether the essential elements of the system of protection adopted are compatible and promote international comity in chip protection. Experience in the §914 hearing process, and developments in WIPO, have demonstrated that the essential elements of compatibility include:

1. Protection of subject matter that includes semiconductor mask works;

2. Originality, rather than novelty, as the criterion for protection;

3. A minimum term of protection of at least 10 years;

4. Compulsory licensing only in carefully limited circumstances required to deal with such issues as retroactive protection; and

5. Provisions to assure the availability of reverse engineering at a level compatible with the SCPA.

The inherent balance of the SCPA compels a careful evaluation of these elements. If they are dealt with in other nation's laws in a materially different fashion, international comity will suffer and trade distortions will result. However, as noted by the representative of the Semiconductor Industry Association during the hearing on the issuance of an interim order for Sweden, if a country chooses to implement these elements under a formality-free copyright system, such an approach "would be quite compatible with our own."

Another area of concern is the process by which the President issues proclamations. Here, the intent of the legislation is less clear, but the history of the parallel provisions of the copyright law may be of some relevance. For nearly one hundred years, the President has had the authority to proclaim copyright relations with foreign governments. Indeed, until the United States joined the Universal Copyright Convention in 1952, the Presidential proclamation process was the principal vehicle for the establishment of these copyright relations. The President exercised this power by exchanging diplomatic notes between the United States and the foreign government that documented that a law was in place to guarantee the effective protection of copyrighted works. This process contemplates a series of government-to-government consultations on the law, and informal discussions with the private sector to assure that interests of U.S. copyright owners are fully protected. A formal hearing and comment procedure has never been part of the process.

The development of the public proceedings under section 914 have clearly demonstrated the usefulness of the public process in the formative stages of a foreign government's laws. Indeed, the information gathered during this process, supplemented by further consultations and possible public hearings on the actual operation of a foreign Government's law could be useful in the government-to-government discussions on the establishment of relations through a Presidential proclamation. While the interpretation of section 902 seems to favor a diplomatic route to the establishment of more permanent relations through section 902, our experience to date leads us to question whether there should be a role for a public hearing as a part of this process. Should Congress determine that a public hearing ought be included in the Presidential proclamation process, we would suggest modifying section 902 to require a hearing, so as to avoid casting doubt on the time-honored practice under section 104 of the Copyright Law.

The last concern expressed is that, once issued, a Presidential proclamation might be irrevocable. That is not the case. Such proclamations would be governed by their own terms, and could be

revoked on grounds stated in the proclamation. It seems likely, in an area of rapidly evolving legal thinking such as this, that the proclamation would include a provision to permit its revocation should the nature and level of protection afforded thereunder change substantially.

In summary, we believe that the present statute contains sufficient guidance for the application of the transitional provisions of section 914 and the more permanent provisions of section 902. In any case, section 914 is transitional and section 902 will be relied upon only rarely when a new international treaty for the protection of semiconductor chip designs is developed. Progress toward the development of a new international regime for the protection of mask works has been unusually rapid. However, it may not prove to be rapid enough to be completed within the three-year window provided in section 914. Good faith efforts to develop chip protection laws are underway in at least the 16 countries to whom interim orders have been extended. Efforts may well be underway in other countries, but they have not chosen to seek interim protection. For example, Switzerland has only recently requested interim protection, and a hearing on their petition will take place on March 5.

As the record of hearings in our Office record has pointed out, the political process in some European States may be complicated by parliamentary elections which would delay progress on chip legislation. Even if all of the States to whom orders have been extended were to pass new legislation by the November 8, 1987, deadline, such legislation would likely not come into effect immediately. Also, the process of extending protection through Presidential proclamations will take time for the necessary domestic and international consultations.

S. 442 would extend the authority of the Secretary to issue interim orders until November 8, 1990. We support an extension of that authority. We believe that the extension should be for an indefinite period beyond 1990. We believe that the interim order process has been important to achieving U.S. goals in improving the protection of intellectual property worldwide. Further, we believe that it will continue to be a valuable tool as other nations develop their own chip design industries and seek to participate in the world market for chips. An indefinite extension of authority to grant interim protection is preferable to a short term extension for several reasons:

- The semiconductor chip industry is a growing industry and other nations can be expected to develop their own industries. The ability for these countries to secure protection in the

world's largest chip market will be a powerful incentive for them to develop their own chip protection law. We simply are not confident that the next three years will see the end of this process.

- Periodic review and reauthorization of this authority requires a needless expenditure of scarce resources to continue a process that all agree is important. In any case, the regular oversight process can be used to review the Department's administration of these requirements.

- We do not believe that the indefinite extension will reduce the incentives of a foreign government to make speedy progress toward enacting their own law. Should progress falter, and the commitment seem less certain the Commissioner could simply refuse to extend or renew an existing order. In particularly egregious cases, our guidelines clearly define a process for cancelling an existing order. Most interim orders have been issued for a period of approximately one year. This allows for reviews of progress in a way that does not needlessly expend scarce government resources.

Consequently, the Administration endorses a proposal to extend indefinitely the Secretary's authority to issue interim protection orders. This process has proved to be an effective tool in promoting international comity in the protection of mask works and we believe its extension would further serve the interests of the United States. This concludes my prepared statement. I shall be happy to answer any questions you may have.

RESPONSE TO WRITTEN QUESTIONS

1. Question - Mr. Quigg, at the hearing on February 26, 1987, you commented on the state of Japan's chip protection law, and stated that the Commerce Department would issue regulations governing Section 902 applications before considering a Section 902 application from Japan. Am I correct in inferring that the Commerce Department would not recommend that the President consider any Section 902 proclamation before the Commerce Department issues regulations governing Section 902?

   Answer - The Patent and Trademark Office is drafting guidelines for section 902 similar to those for section 914 to establish a process for gathering the information needed to make a recommendation through the Secretary to the President to issue a section 902 proclamation. These guidelines will be published before final action is taken to recommend a section 902 proclamation for any country.

2. Question - Mr. Quigg, you mentioned at the hearing that it was helpful when the private sector started commenting on the United Kingdom's 1985 application for a Section 902 proclamation. Later in the hearing you mentioned that you certainly would feel that notice of the Commerce Department's intention to move a Section 902 proclamation forward should be published. What will the PTO's regulations on Section 902 contain in addition to the notice of intention to move forward? Will the Commerce Department incorporate into its regulations on Section 902 an opportunity for public comment? Is there any reason to make the Section 902 regulations less extensive than the regulations governing Section 914.

   Answer - We contemplate procedures for section 902 that will result in a full opportunity for the public to express its views and concerns in order that they may be taken into account in the determination of the appropriateness of issuing a 902 proclamation. If a country requests a section 902 proclamation after having been issued a section 914 order, the request will be published in the Federal Register and written public comments will be solicited. If I decide to initiate a section 902 proceeding on my own motion, a notice of that decision will be published. Because a full public comment period with the possibility of a public hearing is part of the 914 process, we do not contemplate duplicating the public hearing in the 902 procedure. Of course, once a multilateral treaty for the protection of semiconductor chips is developed and the United States

adheres to the treaty, relations will be established when another country adheres to that treaty. In that case the 914 and 902 procedures will not be involved.

3. Question - Mr. Quigg, can you give us some estimate of when the Commerce Department will issue the regulations governing the Section 902 applications. How soon thereafter will the Congress and other interested persons be able to comment on the proposed regulations?

Answer - We contemplate issuing guidelines in a manner similar to those for section 914 before the end of April 1987. If our authority to issue 914 orders is extended, we contemplate issuing a regulation that will integrate both the section 902 and 914 processes.

4. Question - Mr. Quigg, during last week's hearing we discussed the possibility of issuing legislation that would grant the Secretary of Commerce an indefinite extension and coincidentally preclude him from granting interim protection under Section 914 to any nation for greater than a total of five years. At some point, we may find that we do not yet have an international treaty but have several different nations with Section 902 proclamations, encompassing several different forms of chip protection. Could such a development inadvertently undermine international comity? If we did have several different nations with several different Section 902 proclamations, would it be more difficult to craft an international treaty protecting semiconductor chips?

Answer - I do not believe that an extension of the 914 process will be a disincentive to developing international comity in mask work protection. On the contrary, the 914 process has provided the U.S. with a rather unique ability to influence, in a very positive way, legal thinking concerning chip protection in other countries. We do not contemplate recommending a section 902 proclamation unless we are satisfied that a foreign country provides adequate and effective protection for mask works. We believe that this opportunity to encourage uniformity of protection under national laws will promote, rather than deter, the speedy development of a solid international treaty for the protection of mask works, fully grounded in principles of international comity.

5. Question - Mr. Quigg, during our discussion about extending the Secretary's authority under Section 914, we addressed the

limitations of extending that authority for an indefinite period as well as limitations of extending that authority for a time certain. Perhaps there is a compromise between the two. What is your opinion of legislation that would extend indefinitely the Secretary of Commerce's authority to issue Section 914 proclamations, but that would prohibit the Secretary from issuing any individual interim order for longer than 18 months. Do you agree that such a solution would offer protection, eliminate the need for Congress to revisit this issue every three years, and enable the Patent and Trademark Office to regularly scrutinize a nation's "good faith efforts"?

Answer - While we would prefer a three year limit on the duration of interim orders, an 18 months limit is certainly something we could live with.

6. Question - You stated in your written testimony that Section 902 sets out, in a manner similar to Section 104 of the Copyright Law, the criteria upon which foreign mask works will be eligible for a Presidential Proclamation. Later on you state that a Presidential Proclamation issued pursuant to Section 902 would be governed by its own terms and could be revoked on grounds stated in the proclamation. I agree that a proclamation may include a provision to permit its revocation. But your comparison to Section 104 of the Copyright Act invites a question.

That is, should we be concerned that Section 104 specifically states that the President may "revise, suspend, or revoke" a proclamation and Section 902 is silent on that point?

Answer - We concur with the Department of State and the Copyright Office that the President has the inherent power to issue a conditional proclamation or to revoke a proclamation once issued if the basis for its issuance fails to hold true. The fact that section 902 is silent on this point would not seem to cast doubt on such a fundamental principle of Presidential authority.

7. Question - What will be the relationship between the intellectual property conventions that have been or will be developed by WIPO and those standards governing intellectual property that may be developed through future rounds of GATT?

Answer - The intellectual property standards to be developed through the GATT are intended to complement, rather than supplement the treaties developed under WIPO. Most intellectual property treaties have no dispute resolution mechanism

except for referral of disputes to the International Court of Justice if the countries involved cannot resolve the dispute on their own. We expect our work in the GATT to adopt the standards of existing treaties where appropriate and, in some instances, foster the development of new standards either in WIPO or the GATT that go beyond the existing conventions. Also, the GATT enforcement mechanisms should help resolve any disputes that may arise concerning obligations under existing intellectual property treaties or other WIPO or GATT standards.

8. Question - Has the Government found that the standard of "good faith efforts and reasonable progress", as used in the Act, has been adequate to assure that the U.S. is getting genuine reciprocity in terms of genuine progress towards foreign protection for our chip designs?

Answer - We believe that the standard of "good faith efforts and reasonable progress" has thus far been adequate. Countries are always motivated by their own self-interest. Access to interim protection in the world's largest market for semiconductor chips has been a real incentive. Japan has enacted a law, and we have been informally advised that the Swedish parliament has passed a chip protection law. We also must consider the efforts of the European Community to seek uniform protection for chips in its Member States as a real step forward in the process of assuring international comity.

9. Question - There have been some indications that foreign implementation of protection for U.S. chip designs -- as opposed to simply setting up a formal mechanism -- may not be as good as it should be in certain countries. Does the Government have specific information on that issue? If so, please provide it.

Answer - In June of 1986 the Semiconductor Industry Association, on behalf of one of its member companies, contacted the U.S. government to inform us that problems had arisen concerning specific registration applications that had been filed in Japan. Our Office and the International Trade Administration's Office of Japan convened a meeting with U.S. and Japanese representatives to discuss these problems. We then communicated these problems to the Japanese authorities. The problems were speedily resolved. We have received no further complaints since that date. The information supplied to us by the Electronic Industry Association of Japan in June of 1986 indicates that 19 applications from U.S. firms had been filed and all were granted. None have been rejected. In the U.S. Copyright Office as of September 30, 1986, 60 claims had been received from Japan, and 3 of those were refused registration.

Senator LEAHY. Mr. Milam, I understand you do not want us to change the manner in which you process applications for presidential proclamations governed by Section 104 of the Copyright Act. Is that correct?

Mr. MILAM. You mean in respect to public hearings under section 104, Senator?

Senator LEAHY. Yes.

Mr. MILAM. We do not have any strong feelings about it. We are comfortable with the present system of consultation. I might interject here and say that, despite Ralph Oman's characterization, I feel like the subcompact in this group. We certainly, at least I, need to interact with the private sector constantly to keep up with what is going on and we try to do that.

However, if other parts of the Administration and the Congress feel that public hearings are a better idea, we would not object to it. We do not have any strong feelings about it. It is just that things seem to be working pretty well as they are. One of my bosses says that if something is not broken, why try and fix it.

Senator LEAHY. We may well recommend to the Secretary of Commerce that they promulgate regulations establishing a period for public comment before the Department engages in negotiations on a proclamation under the Semiconductor Chip Protection Act. How would State Department feel about that? Would you support that recommendation?

Mr. MILAM. Yes.

Senator LEAHY. Would the normal formal notice be the best way to get public comment?

Mr. MILAM. Yes.

Senator LEAHY. You said, in your written testimony, that if notice and comment were prescribed, the Department of Commerce, in conjunction with the Copyright Office and State Department could consider those comments and make recommendations to the President regarding the issuance of a presidential proclamation under the 1984 Chip Act. Are you saying that public comment makes sense for Chip Act proclamations but not for Copyright Act proclamations, or have I misunderstood this? Or does it make sense for both?

Mr. MILAM. I think so, yes.

Senator LEAHY. Thank you. Mr. Oman, do you agree?

Mr. OMAN. I would agree with that, yes.

Senator LEAHY. One other question, you had mentioned the World Intellectual Property Organization treaty on chip protection in your testimony. Let me make sure I understand. The State Department and Copyright Office are in on those negotiations, is that right?

Mr. OMAN. The Commerce Department—specifically the Patent and Trademark Office—has had a member in the delegation in the person of Mr. Keplinger, who is an adviser to Mr. Quigg.

Mr. LEAHY. So who is over there, the State Department, the Copyright Office, and the Patents and Trademarks Office? Anybody else?

Mr. OMAN. We do have private sector members of the delegation on occasion, and we also have representatives from the groups that have an interest—the Semiconductor Industry Association and

some of the larger corporations have individual members—who serve as delegates of non-governmental organizations.

Senator LEAHY. Thank you.

Gentlemen, I thank you all for being here. The three of you represent far more expertise in this matter than I do, and I appreciate your participation in these proceedings.

[Prepared statement of Mr. Milam follows:]

Statement of William B. Milam,
Deputy Assistant Secretary for International Finance
and Development, Bureau of Economic and
Business Affairs, Department of State,
Concerning S.442 and Other Matters
Regarding the Semiconductor Chip Protection Act of 1984
Senate Judiciary Subcommittee on
Law and Technology, February 26, 1987

I am pleased to be here to testify on behalf of the Department of State in support of S.442. The State Department has long been endeavoring to improve the legal and commercial protection abroad for American industries which are involved in the creation and development of intellectual property.

We supported the enactment of the Semiconductor Chip Protection Act of 1984 (SCPA) because it offered the best prospects for developing an international regime to protect semiconductor chip layout designs produced by the U.S. semiconductor industry. It is quite clear that the Act strongly favors the development of a multilateral treaty as the basis for such protection.

The Department of State supports the enactment of S.442, which would extend until November 8, 1990 the authority of the Secretary of Commerce to issue interim protection to foreign nations under Section 914 of the SCPA. The United States is one of the world's two leading producers of semiconductor integrated circuit products. It is critical not only to gain protection for our works abroad, but also to offer similar protection to foreign works in our markets. The extension of the Secretary of Commerce's authority in this regard offers such protection on an interim basis. This would recognize the efforts of other nations to enact legislation granting similar protection. Eventually, permanent protection for a foreign country could be implemented either by means of a Presidential proclamation or through adherence to a multilateral treaty. Adequate and effective protection of semiconductor chips is most decidedly in the U.S. interest, and also in the interest of all nations.

Section 914 of the SCPA sets forth an "international transition provision" in order to create a favorable climate for foreign nations to develop their own chip protection

legislation. This section allows other nations time to enact their own laws granting similar protection to U.S. works. The authors also designed Section 914 as a stopgap measure to tide the U.S. semiconductor chip manufacturers over until an international treaty was negotiated which would offer adequate chip protection in conjunction with the national legislation of member states.

So far, interim protection under Section 914 of the SCPA has been granted to 16 nations including such leading producers of semiconductor chips as Japan, the United Kingdom, Sweden, The Netherlands and Canada. It is clear that an extension of this interim procedure is necessary because changes to, or enactment of, important legislation frequently cannot be accomplished in a short time frame. A three year extension is a reasonable time frame to permit other nations to enact legislation.

A three-year extension is also a reasonable timeframe to see if an international treaty--which the World Intellectual Property Organization (WIPO) is pursuing expeditiously--offers us the multilateral basis for protection that we seek. WIPO has already had two meetings on the subject of a treaty and a third is scheduled for April. We, of course, are seeking a treaty that is based on the principles found in the Semiconductor Chip Protection Act of 1984, which will therefore provide the kind of effective, uniform protection which we are seeking. There remains a lot of work to do to conclude such a treaty but we remain optimistic that it is possible.

We understand that some questions have been raised which do not directly relate to S.442, but rather concern the procedures under Section 902 of the SCPA. In particular, the concern has been expressed that Section 902, as currently drafted, does not adequately ensure that interested parties' views can be taken into account before a proclamation is issued, and moreover, that it does not explicitly provide for revocation of a proclamation.

We do not believe revocation presents a serious problem under Section 902. It is inherent in Section 902 that the President can revoke as well as issue a proclamation extending protection to another country if conditions change. However, if the Congress deems it advisable, we would support an amendment to Section 902 along the lines of the last sentence of Section 104 of the Copyright Law. This sentence provides that the President may revise, suspend or revoke a proclamation or impose any conditions on protection granted under a proclamation.

Ensuring that interested parties' views are taken into account in the proclamation process is a more serious question. In the issuance of Presidential proclamations under the copyright law, views of the private sector have been solicited on an informal basis. This has worked well in the past. However, if the Congress determines that a problem does in fact exist under Section 902, we would support an appropriate statuatory or regulatory provision to deal with the problem. In our view, the best alternative may be to provide for formal notice and comment procedures. Notice could be published in the Federal Register and written comments from interested parties could be submitted to the Department of Commerce. After receipt of such comments, the Department of Commerce, in conjunction with the Copyright Office and the Department of State, would make a recommendation to the President regarding the issuance of a proclamation.

Senator LEAHY. I call to the table Michael Gadbaw, Ronald Reiling and Charles Ferguson. Mr. Gadbaw is an attorney with the Semiconductor Industry Association. Mr. Reiling is an attorney with Digital and Mr. Ferguson is with the M.I.T. Center for Technology Policy and Industrial Development

Mr. Reiling.

STATEMENT OF HON. R. MICHAEL GADBAW, ESQ., SEMICONDUCTOR INDUSTRY ASSOCIATION; RONALD REILING, ESQ., DIGITAL EQUIPMENT CO.; AND CHARLES H. FERGUSON, M.I.T. CENTER FOR TECHNOLOGY POLICY AND INDUSTRIAL DEVELOPMENT

Mr. REILING. Thank you, Mr. Chairman. I will summarize my comments and ask that the complete text be put into the record.

I am representing and testifying today for the Semiconductor Industry Association—SIA. SIA, as you know, is an association of over 50 semiconductor manufacturing companies, including both the merchant producers, such as Motorola and Texas Instruments and as well as the non-merchant producers, such as Digital Equipment Corp. and IBM. SIA spent over 8 years working with Congress and the Administration in order to enact the Semiconductor Chip Protection Act. The result of this cooperative effort is that the law is fundamentally sound.

I would like to draw upon the experience of my company to give you just one example of the importance of the SCPA. Digital spent several years and many millions of dollars in developing a new chip set which we refer to as the MicroVAX II computer. We timed the introduction of that product to coincide with the legislation protecting our chip because of the importance of intellectual property protection to us. These chips have allowed my company to launch a new generation of low cost computers.

The industry supports the basic thrust of S. 442, which is to extend the Administration's authority to grant interim protection to foreign mask works. However, we believe that the extension of this authority should be provided only subject to certain procedural and substantive assurances, so that the authority is used to further the objectives of the Act.

Benefits under the U.S. law are provided on the basis of reciprocity. If other countries protect U.S. works, the United States may protect their works. In one important aspect, however, the SCPA breaks new ground. An international transitional provision, Section 914, authorizes the grant of interim protection to foreign nationals on the grounds that their governments are making good faith efforts towards the enactment of intellectual property protection for semiconductor designs or provide it under their existing laws.

SIA believes that the process initiated by Sections 902 and 914 have been highly favorable to the international recognition of mask work rights. Outside of the United States, two of the largest markets for semiconductors in the world, Japan and the European Community, have either enacted or are well on their way to enacting semiconductor chip protection by the end of the year. Australia, Canada, Sweden, Switzerland, are each also considering such legislation. As you have noted, the World Intellectual Property Or-

ganization is developing a multi-lateral treaty for the protector of semiconductor designs.

The opportunity Section 914 provides to other countries to obtain immediate protection of the U.S. law in return for allowing the United States to review and comment on the evolution of their law has proven irresistible to a number of key market countries. The Section 914 hearing process itself has become a forum for the dissemination of information and the exchange of views on the appropriate form and terms of protection.

Given this experience with 914, SIA would support the extension of authority as provided S. 442. SIA believes that a limited extension is appropriate and believes the three years provided in S. 442 should afford the necessary time for other countries to enact such legislation.

However, as Congress revisits the issue, we believe that it should act to ensure that certain standards and procedural guarantees are provided. We specifically recommend an opportunity for public comment. We believe that the practice of the PTO in providing full opportunity for public comment has been very helpful. We would like to reaffirm the importance of this process. We believe that this policy of openness should carry over into the issuance of presidential proclamations. There is a prior basis for this in our law.

Secondly, SIA recommends the issuance of interim orders under Section 914, rather than the unconditional issuance of Section 902 presidential proclamations. Our concern is that the piecemeal offering of presidential proclamations could well impair the ability of the United States to press for the highest possible standards in the context of multilateral agreement.

Our final recommendation is Congressional approval of any international treaty. We have participated in the negotiations of WIPO and have provided our views to the U.S. government negotiators. Because of the important role that an international treaty will play in the evaluation of legal regimes in this area, we urge this committee to play an active role in overseeing the negotiation of this treaty. We believe that the agreement, once concluded, should be submitted to Congress for its approval.

Thank you very much, Mr. Chairman, for the opportunity to testify before you today.

[Submissions of Messrs. Reiling and Gadbaw follow:]

Testimony of

RONALD REILING

DIGITAL EQUIPMENT CORPORATION

on behalf of the

SEMICONDUCTOR INDUSTRY ASSOCIATION

Mr. Chairman, I am Ronald Reiling. I am Corporate Counsel to Digital Equipment Corporation, and I appear before you today on behalf of the Semiconductor Industry (SIA). I am accompanied by Michael Gadbaw, who is SIA's Washington counsel. SIA is an association of over 50 U.S.-based manufacturers of semiconductors, which together accounted for more than ninety-five percent of all semiconductors produced in the United States in 1986. I appreciate the opportunity to appear before your Subcommittee today to assess the effectiveness of the Semiconductor Chip Protection Act of 1984 (SCPA), and discuss S. 442, legislation to extend the Secretary of Commerce's authority to issue interim orders pursuant to section 914 of the SCPA.

Mr. Chairman, we are especially pleased to testify here today because the protection of the intellectual property embodied in the designs of semiconductors is critical to the health and competitiveness of the U.S. semiconductor industry. It was the uncertainty and the inadequacy of existing protection that led the industry to seek explicit recognition of semiconductor designs as legally protectable intellectual property. The industry spent over eight years working with the Congress and the Administration toward the enactment of the Semiconductor Chip Protection Act. In this process, the Congress had the benefit of hearing the views of all interested groups, including those of our foreign competitors.

The result is a law that is fundamentally sound. A sui generis form of protection was provided because it was thought that neither patents nor copyrights were ideally suited to cover semiconductor designs. Instead, a new property right was created, drawing on these traditional legal regimes as appropriate to the special form of intellectual creation embodied in mask works. By providing a ten year term of protection, special provisions dealing with reverse engineering and innocent infringement and a unique regime to encourage international reciprocity, Congress has struck an appropriate legislative balance. On the one hand, the Act ensures the creator of a new design that the millions of dollars of research and the countless hours of engineering time cannot simply be appropriated by a pirate. At the same time, society gains the immediate benefits from the dissemination of new technology.

I would like to draw upon the experience of my company to give you just one example of the importance of this legislation. Digital Equipment Corporation spent several years and millions of dollars developing a new chip set known as the MicroVAX II computer. This chip set literally allows us to embody in a semiconductor product the power of a VAX computer that just ten years ago would have taken up the size of this table. Digital timed the introduction of these chips to ensure its protection under the SCPA because

of the importance to us of legal protection for our intellectual property. These chips have allowed my company to launch a new generation of low-cost computers.

From this perspective, the semiconductor industry follows with great interest the developments in other countries leading toward international recognition of mask work rights. In this regard, the industry welcomes the attention that both the Congress and the Administration are directing toward global intellectual property protection. We feel that the reciprocity provision of section 914 has played an essential role in raising the priority of mask work protection in the legislative agendas of key foreign countries.

For this reason, the industry supports the basic thrust of S. 442 which is to extend the Administration's authority to grant interim protection to foreign mask works upon a finding that the particular foreign country is moving toward the provision of protection for U.S. mask works. However, we believe that the extension of this authority should be provided only subject to certain procedural and substantive assurances so that this authority is used to further the objectives of the Act.

In order to put SIA's position into perspective, it is helpful to review our experience with the Act to date, in particular the provisions authorizing the Administration to extend the benefits of the law to foreign nationals.

Sections 902 and 914

In fashioning the international reciprocity provisions of the SCPA, Congress drew upon the legislative schemes in the patent and copyright area. The benefits of U.S. law are accorded on the basis of reciprocity, if other countries protect U.S. mask works, the United States may protect the mask works of that country's nationals (Section 902). However, in one important respect, the SCPA breaks new ground. An international transition provision (Section 914) authorizes the Administration to grant interim protection to foreign nationals on the grounds that their governments are making good faith efforts toward the enactment of intellectual property protection for semiconductor designs or provide protection under their existing legal regimes. [1]

In fashioning a transitional regime, Congress gave expression to the special status that intellectual property rights have acquired in our national priorities. The standard for granting reciprocity refers to foreign protection on "substantially the same basis" as that provided in the United States. Furthermore, because the decision to grant interim protection under Section 914 is subject to the Administrative Procedures Act, a full opportunity is provided to interested parties to give their views on the appropriateness of an order.

SIA believes that the process initiated by these provisions has been highly favorable to the international recognition of mask work rights. Indeed, the results have been so striking that the model commends itself for application to other areas of intellectual property protection.

In the two largest markets of the world for semiconductors outside of the United States -- Japan and the European

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[1] In addition, Section 914 requires the Secretary of Commerce to find that the nationals of the country in question are not engaged in the copying of chip designs and that the purposes of the statute and international comity will be furthered.

Community -- mask work protection has either been enacted or is well on the way toward enactment by the end of this year. The Governments of Australia, Canada, Sweden and Switzerland are each reviewing and drafting chip protection legislation. SIA has supported the granting of interim orders to these countries. Finally, the World Intellectual Property Organization (WIPO) is actively developing a multilateral chip protection treaty.

The Japanese have in effect created a sui generis system of chip protection. On January 1, 1986 the Act Concerning the Circuit Layout of a Semiconductor Integrated Circuit was implemented by the Government of Japan. The Japanese Act is similar to the SCPA in many respects. Exceptions exist in that under the Act protection begins on the date of registration rather than on the date of first commercial exploitation, while under the U.S. law protection starts on whichever is the earlier of the two dates. More importantly, the existence of protection in Japan is contingent upon registration which effectively means that protection is subject to Japanese Government discretion; if a Japanese bureaucrat decides not to register a design, the creator has no mask work rights.

SIA has supported the granting of reciprocal rights to Japan under Section 914 but has not favored the granting of a Presidential Proclamation, because of the uncertainty inherent in the Japanese registration process. SIA has urged the Administration to negotiate an agreement on the mutual recognition of registrations to address these concerns.

On December 1, 1986 the Council of the European Community passed its Council Directive on the Legal Protection of Original Topographies of Semiconductors. The Directive is designed to ensure that integrated circuits are protected in each Member State in accordance with an agreed upon set of basic principles. Under Community Law, the Directive is binding, yet leaves the decision of how best to protect semiconductor products, whether through existing copyright law, or a separate sui generis system to the Member States. Member States are required under the Directive to adopt legislation for the protection of semiconductor designs by November, 1987.

The Government of Canada is reportedly working on revisions to its Copyright Act to protect mask works fixed in semiconductor chips. The Canadians have reported that although their chip legislation will be sui generis in nature, it will be linked to a revision of the Copyright Act. The Swedish Ministry of Justice and Swiss Federal Intellectual Property Office have formed committees to draft legislation to protect semiconductor designs as part of overall revisions of their copyright law. The Government of Australia has asserted that its existing copyright law adequately protects mask works, but is examining an appropriate regime for mask work protection. Next week, the Patent and Trademark Office will consider an application by the Government of Switzerland requesting an interim order.

On the multilateral front, the World Intellectual Property Organization (WIPO) has prepared a draft of a proposed treaty that would provide an international convention under which mask works could be protected through the national laws of treaty signatories. The WIPO Committee of Experts on Intellectual Property in Respect of Integrated Circuits met in Geneva in November of 1985, June of 1986 and will meet again in April of 1987. In its present form the draft treaty would allow for protection of mask works either through copyright or a sui generis law.

It would be an error to attribute these actions of foreign governments as due to the reciprocity provisions of

U.S. law. These sovereign nations acted out of a clear perception of their own national interest. Wherever there is a nascent or internationally competitive semiconductor industry, there is concern about protecting the intellectual property of the domestic industry to promote innovative product development and ensure access to foreign markets unimpaired by the risk of piracy.

It would be as serious a mistake, however, to underestimate the impact of Section 914. The opportunity it affords to other countries to obtain the immediate protection of U.S. law in return for allowing the United States to review and comment upon the evolution of their law has proven irresistible to a number of key countries. The Section 914 hearing process itself has become a forum for the dissemination of information and the exchange of views on the appropriate form and terms of protection. In virtually every case, this international exchange helped to move the legislative process along in other countries at a more rapid pace than might otherwise have occurred. In turn, the United States has gained valuable insights into the thinking of foreign governments and their industries regarding intellectual property protection. These insights have helped the United States advance its international policy goals in this area.

S. 442

Given this salutory experience with the regime created by Section 914, SIA would support the extension of authority as provided in S. 442. SIA believes that a limited extension is appropriate and believes the three years provided in S. 442 should afford the necessary time for other countries to enact legislation. However, SIA believes that as Congress revisits the issue, it should act to ensure that certain substantive standards and procedural guarantees are provided.

Specifically, SIA recommends the following:

1. An Opportunity for Public Comment

With certain exceptions, it has become the practice for the Patent and Trademark Office to provide a full opportunity for public comment, including a public hearing, regarding the issuance of a Section 914 interim order. SIA would like to reaffirm the importance of this process.

In some cases, the opportunity to comment allowed the United States to provide input into the legislative process abroad that would not otherwise have been possible because of the nature of foreign legislative processes. We believe the openness and transparency of the decision-making process has had a very positive impact on the outcome of decisions under Section 914. SIA has received very positive reactions to the process from a number of foreign groups that have participated.

SIA believes that this policy of openness to public comment should carry over into the issuance of a Presidential Proclamation. There is clear precedent in the international arena for decisions regarding the issuance of Presidential Proclamations to be open to public scrutiny and debate. We suggest that the procedures in our trade laws provide an appropriate model in this regard. [See 19 U.S.C. §§ 2151, 2153, et seq.]

2. Issuance of Presidential Proclamations

As important as the issuance of an interim order may be, the issuance of a Presidential Proclamation granting permanent reciprocal rights is even more so. Since the enactment of the SCPA, SIA has promoted the issuance of interim orders under Section 914, rather than the unconditional issuance of Section 902 Presidential Proclamations. SIA is concerned that the piecemeal granting of Presidential Proclamations could well impair the ability of the United States to press for the highest standards of protection in the context of a multilateral agreement. It is the SIA's belief that protection of foreign national's mask works through the extension of interim orders should continue indefinitely until all countries receiving protection under current interim orders allow an equivalent level of protection, ideally through a binding international treaty.

3. Congressional Approval of any International Treaty

SIA has supported the negotiation of an international agreement governing mask work protection. While the reciprocity provisions of U.S. law have worked well to stimulate action in our key trading partners, the broader international community can only be reached through a multilateral mechanism. SIA has actively participated in the negotiating process and has provided its views to the U.S. Government negotiators.

In particular, SIA has emphasized the important of the treaty coverage, compulsory licensing, reverse engineering and dispute settlement.

With regard to definitions, it is critical that at a minimum, the treaty cover products that are covered under U.S. law. Coverage of semiconductor integrated circuits, equivalent to that provided by the "semiconductor chip product" and "mask work" definitions of the Semiconductor Chip Protection Act of 1984 (SCPA), must be included in the text of the treaty. It is SIA's position that broader coverage (i.e., "layout design") may be included in the treaty, but this coverage should be optional. Furthermore, the United States should take no action which would limit the application of U.S. law.

Compulsory or "non-voluntary" licensing provisions are completely unacceptable to the U.S. semiconductor industry and should be prohibited at all costs. SIA has urged the U.S. delegates to strongly oppose any compulsory licensing proposal within WIPO.

With regard to reverse engineering, it is important that the United States not accede to a treaty which allows would-be infringers the opportunity to establish operations in a signatory country with less stringent reverse engineering provisions than exist under U.S. law. For this reason, any provision allowing for the importation of a chip lawfully made, and subject to protection in the treaty, is unacceptable to the U.S. semiconductor industry.

Similarly, the innocent infringement provision in the treaty should be compatible with the SCPA. In the case of innocent infringement, liquidation of inventory must be accompanied by the payment of a royalty. The language of the treaty should not allow for the granting of a perpetual license.

Finally, concerning a provision for a consultative mechanism, it is SIA's position that a treaty which is not enforceable has little value. The absence of such provisions in treaties dealing with patents and copyrights has been widely criticized by U.S. industry and the United

States is seeking to correct these deficiencies in the new GATT round. SIA appreciates the effort that went into the U.S. consultation and dispute settlement proposal. It is critical, that provisions along these lines be included in the treaty.

Because of the important role that an international treaty will play in the evaluation of legal regimes in this area, we urge this Committee to play an active role in overseeing the negotiations. Indeed, SIA believes that the agreement, once concluded, should be submitted to the Congress for its approval. Such a submission would give the Congress an opportunity to review the results and consider any changes in U.S. law that may be necessary or appropriate to advance legal protection of semiconductor designs.

Thank you very much Mr. Chairman for the opportunity to testify before your subcommittee on this subject of obvious interest to SIA and to my company.

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The Semiconductor Chip Protection Act of 1984 – Experience in the Utilisation of the Law and Current International Developments

Introduction – International Reciprocity under the SCPA

The United States Semiconductor Chip Protection Act (SCPA),[1] was enacted by the 98th Congress and made effective as of 8 November 1984. In the United States, the passage of the SCPA was unique in the field of intellectual property rights, for it created the first intellectual property right outside the traditional categories of patents, trademarks, and copyright principles. This *sui generis* right was specifically designed for, and limited to, semiconductor chip designs but draws extensively on patent and copyright principles.[2]

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1 Semiconductor Chip Protection Act of 1984, Pub. L. No. 98-620, tit. III, 98 Stat. 3347 (codified at 17 USC §§901 to 914 (Supp. II 1984). The date of enactment was 8 November 1984, when the Bill was signed by the President.

2 The semiconductor chip was invented in 1959. HR Rep. No. 781, 98th Cong., 2d Sess. 2 n. 2, reprinted in US Code Cong. & Ad. News, 1984, at 5750, 5751.

> The development of chip technology over the past 20 years has transformed the operation of many homes and businesses. A semiconductor chip, which is smaller than a fingernail, can do more than the computer of 30 years ago. As a result of chip technology, firms may produce more efficiently such products as automobiles, ovens, telephones, radios, television sets and washing machines, making them available at lower cost to a greater number of consumers. In addition, firms have been able to develop new products, such as personal computers, hand-held calculators, word processors, video games, and digital watches. As a result of these innovations, firms are better able to compete in world markets.

See S. Rep. No. 425, 98th Cong., 2d Sess. 4-5, reprinted in Colberd, 'Copyright, Computer Software and Preemption' (1984) 1 *Computer Software* 69, at 197 to 198.

The reciprocity provisions of the SCPA, and the importance of obtaining coverage under the US law, appear to have catalysed the development of chip design protection legislation in a number of countries. The Japanese have a semiconductor design protection system which became fully operational in January 1986.[3] Efforts are also underway within the European Community to issue a binding Directive requiring all EEC members to pass chip protection laws or to protect chip designs under copyright law.[4] A number of EEC Member States have already taken steps to comply with the Directive.[5] Finally, Canada, Sweden and Australia all have legislative projects underway to provide protection to semiconductor chip designs.[6]

On the multilateral front, the World Intellectual Property Organization (WIPO) is in the midst of developing a draft multilateral treaty for the protection of integrated circuits (microchips) from copying and other forms of piracy.[7]

While a number of countries appear to be acting in response to the reciprocity provisions of the SCPA, action seems to be taken not for fear of retaliation, but

3 In Japan, the new Act Concerning the Circuit Layout of a Semiconductor Integrated Circuit, Law No. 43 of 1985, became effective on 1 January 1986 and Japanese authorities are accepting and issuing chip registrations.

4 See Commission of the European Communities, COM (85) 775 final, Proposal for a Council Directive On the Legal Protection of Original Topographs of Semiconductor Products.

5 The United Kingdom has proposed to protect original designs of all articles (including spare parts), which are not artistic works, by a new non-registered design right. This design right would protect the designs of articles first marketed by a British national or any person resident or domiciled in the United Kingdom, or elsewhere in the European Communities, or in a country which protects UK functional designs. See Department of Trade and Industry, 'Intellectual Property and Innovation', Her Majesty's Stationery Office, London, presented to Parliament by the Secretary of State for Trade and Industry by Command of Her Majesty, April 1986.

6 In Sweden, the report of the Swedish Committee for the Revision of the Copyright Law, and the comments received from Government of Sweden, clearly indicate progress. Legislation is expected to be passed in the Autumn of 1986. This effort continues to be strongly supported by Swedish industry.

In Australia, the Government's submission to the Patent and Trademark Office indicates that consultations on the appropriate future policy to be pursued concerning chip protection are under way, and that the doubts concerning the application of Australian copyright law to semiconductor chip protection have been largely answered following the High Court's decision in *Edwards Hot Water v Solarhand*.

In Canada, the Government is actively pursuing the enactment of a copyright oriented, *sui generis* system for the protection of semiconductor chips.

All of these countries are actively working in the WIPO forum to pursue the negotiation of a new treaty for the protection of semiconductor chips.

7 See Committee of Experts on Intellectual Property in Respect of Integrated Circuits, World Intellectual Property Organization, 'Draft Treaty on the Protection of Intellectual Property in Respect of Integrated Circuits', 29 November 1985. The nature of an appropriate international legal regime for the protection of semiconductor chips is being actively discussed in the World Intellectual Property Organization (WIPO) where a group of experts will meet again from 23 to 27 June 1986, to discuss a draft treaty for the protection of integrated circuit chips. That process has made it clear that while there is a broad general agreement that this frontier technology deserves legal protection, there are questions about the specific features of such a new, *sui generis*, system of protection that must be addressed.

as a clear perception of national interest. Every country with a nascent or internationally competitive semiconductor industry should be concerned about protecting the intellectual property of its industry and ensuring that its product can be marketed worldwide.

Protection to foreign designs under the US statute does not automatically extend to foreign nationals but is generally based upon the principle of reciprocity.[8] Two provisions in the SCPA provide for the protection of foreign mask work designs. Section 902 was modelled after US copyright law, but the reciprocity section 914 was original.[9]

The result is two standards that are not perfectly compatible because the standard for present protection via a Presidential proclamation is easier to meet than that for an interim designation. The differences in the reciprocity provisions of section 902 reflect the fact that the US Congress included provisions for both 'national' treatment and 'substantially equivalent' treatment.

The transition period provision, section 914, provides a three-year period from 8 November 1984 to 8 November 1987, whereby nationals of foreign countries can register their designs in the United States through temporary interim orders, granted by the Patent and Trademark office.[10]

In theory, section 914 of the SCPA was drafted by Congress to encourage other nations to develop systems for the protection of semiconductor chip designs. The Secretary of Commerce (through the Patent and Trademark Office) has the authority to waive the reciprocity requirement if he finds that:[11]

> (1) the country in question is making good faith efforts toward legislation or a treaty;
> (2) the nationals of the country are not engaged in the copying of chip designs; and
> (3) the purposes of the statute and international comity would be furthered by the waiver.

After the three year transition period, foreign nationals may register mask works only pursuant to a Presidential finding that their country extends protection to US mask works either by treaty or domestic law.[12] Section 902(a)(2) provides that foreign mask works are eligible for protection whenever the President finds that a foreign nation extends to mask works of owners who are nationals of the United States treatment substantially equivalent to that provided by the SCPA, or on substantially the same basis as is provided to works of its nationals.[13]

Another route exists by which a foreign nation can qualify for reciprocal treatment order under the SCPA. The foreign nation can qualify for reciprocity by becoming a signatory to a treaty providing mask work protection to which the United States is also a party.[14]

In the review process prior to a 'rollover' of an interim order or section 902 Presidential declaration of permanent protection, the Secretary of Commerce will not be looking for a mirror image of US law. Before reciprocal protection is granted to Japan and EEC Member States, the United States will have to determine whether these nations grant US mask works the same level of protection accorded its own nationals, or treatment 'substantially equivalent' to the US Semiconductor Chip Protection Act. Thus, the concepts of exclusive rights, registration procedures, notice provisions, and enforcement mechanisms must be carefully analysed with reciprocity in mind. This article will look at the application of the reciprocity standard under the US law to Japanese, European and WIPO chip protection legislation.

The US Semiconductor Chip Protection Act – Current Experience and Comparison

Interim orders – status

Already 14 countries have applied for and received such interim orders. The summer of 1986 will be a busy one for the US Patent and Trademark Office. The majority of outstanding interim orders will be expiring at this time, and the Patent and Trademark Office must decide whether to 'roll over' the interim orders for another term, or grant permanent protection under a Presidential Proclamation.

Interim orders have been granted under the SCPA to nations showing good faith efforts in enacting their own

8 See 17 USC § 902(a)(2) and 914 (Supp. II 1984).

9 See R. Stern, *Semiconductor Chip Protection*, Harcourt, Brace, Jovanovich/Law and Business, New York, 1986, at 414 to 441, for a comparison of SCPA §§ 902 and 904.

10 SCPA § 914 'sunsets' on 8 November 1987, but it may be extended. See SCPA § 914(e).

11 *Ibid.*, § 914; see Guidelines for the Submission of Applications for Interim Protection of Mask Works, 49 Fed. Reg. 44,517 (1984). Any foreign governmental agency that petitions for interim protection must provide, *inter alia*, evidence of that nation's progress toward protecting mask works, including (1) copies of bills introduced in the foreign legislature; (2) copies of legislative proposals by responsible agencies; (3) records of international proceedings of negotiations showing efforts toward developing an appropriate treaty; (4) reports of Governmental or private sector commissions studying and making recommendations on appropriate measure; (5) correspondence between private sector organisations and responsible Governmental organisations; and (6) any other material, such as executive proclamations, resolutions or regulations that would support the claim of good faith efforts.

12 *Ibid.*, § 902(a)(2)(B).

13 17 USC § 902 provides that:

> (a)(1) Subject to the provision of subsection (b), a mask work fixed in a semiconductor chip product, by or under the authority of the owner of the mask work, is eligible for protection under this chapter if
> (c) the mask work comes within the scope of a Presidential proclamation issued under paragraph (2).
> (2) Whenever the President finds that a foreign nation extends to mask works of owners who are nationals or domiciliaries of the United States protection (A) on substantially the same basis as that on which the foreign nation extends protection to mask works of its own nationals and domiciliaries and mask works first commercially exploited in that nation, or (B) on substantially the same basis as provided in this chapter

14 SCPA § 902(a)(1)(A)(ii) grants protection to a mask work of a national, domiciliary or sovereign authority of a foreign nation that is a party to a treaty affording protection to mask works to which the United States is also a party. No such treaty yet exists, although WIPO is currently doubting its new international convention for the protection of semiconductor design

chip protection laws.[14] These nations and their expiration dates are as follows:[15]

Japan	6 June 1986, extended to 12 September 1986
United Kingdom	8 November 1987
Sweden	13 June 1986, extended to 12 September 1986
Australia	21 June 1986, extended to 12 September 1986
Canada	27 June 1986, extended to 12 September 1986
EEC	12 September 1986

Included under the EEC grouping are France, Luxembourg, Italy, Denmark, Belgium, Netherlands, Federal Republic of Germany, Ireland and Greece.[17] The Patent and Trademark Office granted one interim order to EEC Member States, all of whose protection expires on 12 September 1986.[18]

Exclusive rights under the US Semiconductor Chip Protection Act

Traditional copyright law protects the design of a useful article only to the extent that it – as a design – can be identified separately from, and is capable of existing independently of, the utilitarian aspect of the article.[19] At the same time patent laws protect only those developments in semiconductor technology which meet the patent law criteria that the invention not be 'obvious', a legal standard not met by the design of most semiconductor chips.[20] Prior to the enactment of the SCPA, semiconductor manufacturers previously were not able to invest the substantial sums necessary for R and D on new chips with any degree of confidence that they would be able to prevent, or recoup damages for, unauthorised copying of the chips.[21]

Under the original SCPA, the owner of a registered mask work has exclusive rights to do or to authorise any of the following:

> (1) to *reproduce* the mask work by optical, electronic or any other means;
>
> (2) to *import* or *distribute* a semiconductor chip product in which the mask work is embodied (or a product incorporating such semiconductor chip product); and
>
> (3) to induce or knowingly to cause another person to do any of the acts described in paragraphs (1) or (2).[22]

These exclusive rights are limited with respect to three circumstances:

> (1) *First sale*: once the chip product is first sold, the purchaser of the chip is free to import or distribute that chip but may not reproduce it.[23]
> (2) *Innocent infringement*: an innocent purchaser of an infringing chip product (that is, someone who purchased the pirate chip without notice that the mask work was protected) is liable only for a reasonable royalty for those chips purchased before having notice and imported or distributed after such notice.[24]
> (3) *Reverse engineering*: it is not an infringement to reproduce mask works for the purpose of reverse engineering and the reverse engineer is entitled to use the results of such analysis in producing a new mask work if the new mask work is original, is not substantially identical, and involved significant toil and investment.[25]

The exclusive rights in a mask work technically begin on the date a mask work is registered or the date on which a mask work is first commercially exploited, whichever comes first.[26] Protection ends on the last day of the calendar year that is ten years after the year on which the mask work was first registered or commercially exploited.[27] The US chip protection act protects 'mask works' that meet the following requirements:[28]

> (1) *Nationality*: unless the mask work is first commercially exploited in the United States the owner must be a national or domiciliary of the United States or of a country that is entitled to reciprocity

15 17 USC § 914(a)(1)(B).

16 See Patent and Trademark Office, 'Extension of Previously Granted Interim Orders Under The Semiconductor Chip Protection Act of 1984' in Federal Register Volume 51, No. 56, 24 March 1986, at 10073 to 10097.

17 Spain and Portugal will not be covered under the present EEC interim order.

18 On 19 May 1986 the Commissioner of Patents and Trademarks extended the interim orders for Japan, Sweden, Australia and Canada to coincide with the interim order expiration date of the European Community on 12 September 1986. A public hearing was scheduled for 9 July 1986 to review specific features of proposed legislation. See Patent and Trademark Office, 'Extension of Previously Granted Interim Orders Under the Semiconductor Chip Protection Act of 1984', in Federal Register Volume 51, No. 96, Monday, 19 May 1986.

19 17 USC § 102 (1982).

20 See 35 USC §§ 102 to 103 (1982). Patent law requires that an invention be 'novel' and not 'obvious'. To meet the 'unobviousness' standard, an invention must represent a significant enough advance over the prior state of the art so that an ordinary mechanic skilled in the art could not have made this advance.

21 The Semiconductor Chip Protection Act of 1983: Hearings on S. 1201 Before the Subcomm. on Patents, Copyrights & Trademarks of the Senate Comm. on the Judiciary, 98th Cong., 1st Sess. 69–75 (1983) (prepared statement of F. Thomas Dunlap Jr).

22 17 USC § 905 (Supp. II 1984).

23 17 USC § 906(b) (Supp. II 1984).

24 17 USC § 907 (Supp. II 1984).

25 17 USC § 906(a) (Supp. II 1984).

26 17 USC § 904(a) (Supp. II 1984).

27 17 USC § 904(b) (Supp. II 1984).

28 A question also arises as to the applicability of the SCPA and other national laws to ever-advancing chip technology. A number of design houses and manufacturers no longer use masks to produce their chips, but rely entirely on electron beam technology, which are driven by the design data within computer aided design (CAD) systems. The US law takes into account this trend by defining a mask work as a 'series of related images, however fixed or embodied, having or representing the predetermined, three-dimensional pattern of metallic, insulating, or semiconductor material present or removed from the layers of a semiconductor chip product', 17 USC § 901(a)(2)(A).

from the United States (see 'International Reciprocity').

(2) *Originality*: the statute will not protect mask works that are not original or consist of designs that are staple, commonplace or familar in the semiconductor industry, or variations of such designs, combined in a way that, considered as a whole, is not original.[29]

(3) *Ownership*: the exclusive rights in a mask work belong to the owner of *all* rights in the mask work. That owner of a mask work is the creator of that work or his or her employer is the owner if the work was created by an employee within the scope of his or her employment.[30]

Registration – SCPA

To obtain the benefits under the US statute, a mask work must first be registered with the Copyright Office.[31] Mask works must be registered within two years after the date on which the mask work is first commercially exploited anywhere in the world.[32] The US statute applies fully to mask works first commercially exploited after the date of enactment.[33] The Register of Copyrights is responsible for registering claims of protection for mask works.[34] The US Register is required to prescribe forms, establish reasonable registration fees, examine applications and issue certificates of registration. The registration process is important, because it affords owners of mask work rights the opportunity to create a clear evidentiary basis for the existence of their rights which can be referred to whenever a challenge is raised in litigation or otherwise.

The US Copyright Office has now had a little over one year's experience in registering mask work designs, and the registration process itself has brought up a number of interesting developments. To date the US Copyright Office Mask Work Unit has had a great deal of success under the current registration process. Problems, when they have arisen, have stemmed from minor misunderstandings in the registration process itself.

At the close of 1985, 1,880 claims had been filed with the US Copyright Office's Mask Work unit. Of the 1,263 registrations accepted, 717 were from the United States, 481 from Japan, 39 from the UK, 10 from the Netherlands, 6 from Sweden, 5 from Canada, 2 from France, 2 from Italy, and 1 from the Federal Republic of Germany.[35]

Of the 139 refused registrations, 107 were from the United States, 11 from France, 17 from the Federal Republic of Germany, and 4 from Canada. The grounds for refusal are rather varied under the SCPA. Forty-seven were commercially exploited before 1 July 1983, or had incomplete deposits by the 1 July 1985 deadline. Twelve did not meet the *de minimus* 'originality' requirement, and five were not fixed in a semiconductor product. Forty refused registrations were both *de minimus* and not fixed in a semiconductor chip product. Only one refused registration was embodied in another claim. As of January 1986, 478 claims were still in process.[36]

Common problems with registration include missed deadlines (some claims were commercially exploited before 1 July 1983 or registrations were not submitted by 1 July 1985), attempts to register circuit boards or other products which are not semiconductors, and faulty descriptions of the 'nature of contribution', otherwise known as the originality description. Many applications describe their claim in terms of circuiting, application, function, physical characteristics or the various technology processes involved.[37] These developments are not protectable under the SCPA, but may be protectable under patent law. In the Space 8 originality section, it is necessary instead to describe the mask work design, layout, or configuration. There is no time limit for an appeal on a rejection on the basis of originality, and at least five companies have reportedly been considering such an option.[38]

Problems have also routinely arisen in the area of deposit material. Special relief requests (for the purpose of trade secret protection) are often not in order, there is often lack of a whole deposit, or the submission of entire wafers, and identification problems (conflicting numbering systems) have arisen. In one case there was only a CAD (computer aided design) drawing submission. As the design was not embodied in a chip, it was unregistrable. In another case, a partial cell deposit from a completed chip was sent in, which was rejected on the grounds that a cell itself cannot be accepted. Under the SCPA, the entire design of a chip must be registered, as a whole.[39] Some problems have arisen with the registration of gate arrays and cell libraries.[40]

29 17 USC § 902(b) (Supp. II 1984).

30 17 USC § 901(a)(b) (Supp. II 1984).

31 17 USC § 904(a) (Supp. II 1984).

32 17 USC § 908(a) (Supp. II 1984).

33 17 USC § 917(c) (Supp. II 1984). However, a transition provision applied to mask works commercially exploited on or after 1 July 1983 and before the date of enactment. Those mask works were to be registered by 1 July 1985 and are protected as follows: Chips which infringe such mask works and are manufactured before the date of enactment may be imported or distributed for a period of two years after the date of registration of the mask work, *provided that* the importer or distributor first pays or offers to pay a reasonable royalty to the mask work owner. 17 USC § 902(a)(2) (Supp. II 1984). Mask works first commercially exploited before 1 July 1983 are not protected by the statute, but the statute explicitly leaves intact any protections such mask works may enjoy under other Federal or State laws.

34 17 USC § 908 (Supp. II 1984).

35 Melissa Dadent, Mask Work Unit, Library of Congress Department MW, Washington, DC 20540, 18 February 1986.

36 *Ibid.*

37 At present the Copyright Office has a 53 per cent 'correspondence rate', meaning that 53 per cent of all submitted registration forms require written correspondence to resolve various application problems.

38 *Ibid.*

39 17 USC § 901(a)(2) defines the concept 'fixed in a chip'.

40 See Richard H. Stern, 'Proprietary Rights in Computer Software', *IEEE Micro*, June 1985, at 73 to 78. Stern notes that [illegible] PA

Notice – SCPA

Some rights to receive royalties under the SCPA accrue only after the user of an infringing mask work receives notice that the mask work is protected. The statute gives the owner of the mask work the option to provide notice of the owner's mask work rights by affixing notice to the mask work and any semiconductor chip product embodying the mask work.[41] The Copyright Office is called upon to issue regulations providing examples of methods of affixing reasonable notice.

The notice must consist of Ⓜ or *M* and the name of the owner of the mask work. The affixation of a mark is not a condition of protection under the statute. However, it constitutes *prima facie* evidence of notice, should one have to resort to court or administrative enforcement.

Enforcement of rights under the SCPA

The SCPA provides a variety of forums in which the owner of a protected mask work can enforce his or her rights against infringing merchandise – the US Courts, the US Customs Service, the US International Trade Commission and the US Postal Service.[42] These are the same forums that are responsible for the enforcement of rights under US copyright law.[43] These avenues of relief are in addition to, rather than in lieu of, each other.[44] The best forum or forums in which to enforce rights granted under the SCPA will depend upon such factors as whether the infringing products are imported, and if so, the number of foreign producers which are exporting infringing merchandise to the United States, whether the infringing imports are coming in through more than one port, how clear it is that the imported product infringes the protected mask work, the extent to which infringing imports have already secured US market share, and the form of relief desired.

Japanese Chip Protection

The Japanese chip protection scheme

One of the more progressive countries in the field of semiconductor chip protection is Japan. This is not surprising given the fact that the Japanese semiconductor industry approximates that of the United States in value of production.

The Act Concerning the Circuit Layout of a Semiconductor Integrated Circuit[45] was promulgated by the Government of Japan on 31 May 1985 and took effect on 1 January 1986. The content of the Act is basically similar to the US law, with three major differences:

permits the registration and protection of a 'semiconductor chip product', and as that term includes unpersonalised gate arrays, they may be registered. A problem has arisen, however, with the Copyright Office. It had issued a regulation that 'registration will be refused for the mask work (chip topography) as fixed in an intermediate form, if fixation in a final form has occurred before registration is sought, (37 CFR § 211.4(e)(2), 50 Fed. regulation 272, 3 January 1985). That means that a gate array firm cannot protect the unpersonalised form of a gate array if the firm has ever made the gate array in a 'final' form, that is, with a metal, personalised layer. Since it is not ordinarily possible to tell whether a gate array design works until it has been fabricated with metal interconnections and tested, all gate array makers prepare a gate array with metalisation and test it before finalising the design and making thousands of wafers. As far as the Copyright Office is concerned, however, doing this is inimical to the policies of the SCPA; and thus it bars registration. The semiconductor industry has protested to the Copyright Office and urged that it reconsider.

The legislative history of the SCPA has indicated Congress's desire to protect cells and cell libraries several times. Thus, the House Report states that a cell is protectable if it meets the originality requirements of the new law (House Report No. 98-781 (1984) at 26 to 27). The Senate Report states that copying an individual cell forming part of a cell library is an infringement when the cell layout is not dictated by the function of the cell and the copying is close enough for the late cell to be 'substantially similar' to the first (Sen. Report No. 98-425 (1984), at 17). Clearly, Congress was informed about the economic importance of cell libraries and expected them to be protected under the new law.

Yet, as in the case of gate arrays, the Copyright Office has issued regulations the effect of which is to deny registration of cells in most instances. First, the Copyright Office applies to cells the same rule discussed earlier as to gate arrays – that the cell library proprietor must not make in final form any actual chip that includes the cell prior to registration, upon pain of losing the right to register the cell. Apparently, the Copyright Office wants to register cells only before the designer has had an opportunity to ascertain whether the cell works.

41 17 USC § 909 (Supp. II 1984).

42 17 USC § 905 (Supp. II 1984). Section 910(b) of the Act allows the owner of the mask work to bring a civil action for infringement, which is similar to a copyright action. 17 USC § 911(c) (Supp. II 1984) sets maximum damages at $250,000 which is much higher than the $50,000 allowed a copyright owner. A court may also issue temporary restraining orders, preliminary injunction or may order non-statutory damages, based on actual damages and the infringer's profits. 17 USC § 911(a)(b) (Supp. II 1984).

43 The procedures and remedies available for the protection of mask works under the Semiconductor Chip Protection Act of 1984 were modelled after and are essentially the same as those provided in US copyright laws. Compare §§ 910–11 of the Semiconductor Chip Protection Act of 1984 to 17 USC §§ 501–509 (1982). See Report of the Committee of the Judiciary of the US House of Representatives on the Semiconductor Chip Protection Act of 1984, Rep. No. 781, 98th Cong., 2dSess. 25–28 (1984). 17 USC § 905 (Supp. II 1984).

44 S. Rep. No. 781, 98th Cong., 2d Sess. 27 (1984). See also 19 USC § 1337(a) (1982). Although the four avenues of relief are not mutually exclusive, the courts or any one of the agencies involved could decline to take account, pending the outcome of a concurrent proceeding involving the same or essentially the same matter. For example, the statute specifically provides that the Customs Service or the Post Office may require, as a condition of their exclusion of imported mask works, a court order or an exclusion order from the US International Trade Commission. Section 910(c)(1). In addition, the Commission can, in its discretion, suspend its investigation because of proceedings involving similar questions concerning the subject matter of its investigation. 19 USC § 1337(b)(1).

45 Basic Scheme Regarding Registration for Establishment of a Circuit Layout Right, and Public Notice, Perusal and Copying Thereof to be Provided for by MITI Ordinance and Cabinet Order in Accordance with the Act Concerning the Circuit Layout of a Semiconductor Integrated Circuit (Law No. 43, 1985), Japan, July 1985, Ministry of International Trade and Industry. Thereafter referred to as the Act.

(1) protection is extended to all persons, regardless of nationality whereas the US law is based on the principle of 'reciprocity';
(2) protection begins on the date of registration under the provisions of the Act rather than on the date of first commercial exploitation, while under the US law protection starts on whichever is the earlier of the two dates;
(3) infringement may result in criminal punishment, as is the case with all other intellectual property laws in Japan.

The Japanese have in effect created a *sui generis* system of chip protection. This lends support to the US effort to promote an international regime of semiconductor chip protection.[46]

For the most part the Japanese chip act is very close to the American system. The most significant difference is that under Japanese law, the mask work right is granted by the government in the registration process while under US law, the right is granted as a matter of law, not ministerial discretion.[47] Some definitional differences have also appeared. The US SCPA protects the 'mask work fixed in a chip', a concept which is carefully defined. In contrast, the Japanese Act uses the term 'circuit layout' which is a rather broad term.[48] The status of gate arrays and cell libraries, as well as the concept of 'fixed in a chip' are not yet detailed.[49]

In response to the definitional issues raised by observers of the Japanese system, the Ministry of Trade and Industry (MITI) has claimed that these definitional problems are of slight concern as they can be resolved by the enactment of Ministerial regulations issued in concurrence with the Act.[50]

Exclusive rights – Japan

Under the Japanese Act, the creator of an original circuit layout acquires an exclusive right for the manufacture of integrated circuits by utilising the circuit layout, and the transfer, lease, exhibition and import of such integrated circuits for business purposes ('circuit layout right') by registration.[51] Thus under the Japanese Act, rights are conferred not by 'use for business purposes', but only by the act of registration. Thus registration itself takes on greater significance. A circuit layout right is created upon registration, and the right will last for a term of ten years.[52]

Initially, the US Government had some specific concerns with the Japanese Basic Scheme. These may or may not be resolved by enactment of MITI regulations. For example, under the Japanese law a document must be submitted explaining that the applicant is the creator of the circuit layout or such person's successor (referred to as the 'creator, etc.').[53] In contrast the SCPA uses the concept 'owner',[54] and where the US uses the term 'commercial exploitation', the Japanese instead use the term 'used for business purposes'. This concept includes manufacture, transfer, lease, exhibition for the purpose of transferring or leasing, and importation.[55]

46 The Ministry of International Trade and Industry (MITI) began to study legislative measures in October 1984 by establishing the Subcommittee on Legal Problems Concerning Semiconductor Chips in the Industrial Structure Council. Among the members of the Subcommittee were representatives of Intel Japan KK and Texas Instruments Japan Ltd, both US affiliates. Upon receipt of the Subcommittee's report to the effect that Japan needed a new law similar to that of the US, MITI set about drafting an Act. In the course of the drafting, MITI asked and received comments on an outline of the Act from US affiliated companies, as well as exchanging opinions on the outline unofficially with the Office of the Semiconductor Industry Association. The Act was drafted with due consideration for the views expressed on these occasions, and was implemented on " January 1986.

47 Compare § 903(a) SCPA to Japanese Act, Article 3(1).

48 The Act, Article 2(2): 'A circuit layout in this Act shall mean a layout of circuitry elements and lead wires connecting such elements in a semiconductor integrated circuit'. MITI officials have stated that the term 'circuit layout' is the literal translation of a Japanese word 'kairo haichi', which is an equivalent of the term 'mask work' used in the Semiconductor Chip Protection Act of the United States. It is also referred to as 'layout-design' or 'topography'. 'Outline of the Japanese System for Protection of the Circuit Layout of a Semiconductor Integrated Circuit' (MITI draft, April 1986).

49 The Administrative Litigation Act of 1962 (Law No. 139) allows an administrative decision, such as failure, under Article 44 of the bill, to direct the registration organ to register a cell library, to be appealed to the courts. The right to a judicial decision as to whether cell libraries may be registered under the Japanese bill is not lost through the failure of the bill to mention 'cell libraries', just as the right to such a determination under the US Act will not be lost because that Act fails to mention them. Additional Statement of Robert S. Schwartz, Tanaka, Walders and Ritger, on behalf of the Electronics Industries Association of Japan (EIA) to the Patent and Trademark Office, 13 May 1985, re: Interim Protection for Mask Works of Japanese Nationals, Domiciliaries and Sovereign Authorities, 50 FR 12355.

50 MITI document 'Answers to Questions and Comments on the Japanese Chip Protection Act' presented at the Market-Oriented, Sector-Specific (MOSS) talks, Tokyo, 26 April 1985.

51 The Act, Article 10(1).

52 The Act, Article 10 'Creation and Term of a Circuit Layout Right'.

53 According to MITI officials, the ordinance and Cabinet orders will not include a definition of 'creator' because they are implementing regulations, not commentaries on the Act. The courts, not government agencies, have the authority and responsibility of final interpretation of the texts of law in Japan, just as in the United States. However, the Japanese word 'sosaku' (translated in the English version as 'to create'), also used in the Japanese Copyright Act, means to create something for the first time. Therefore, it is impossible 'for a company to copy another's as yet unregistered semiconductor chip and obtain a circuit layout right on it'. MITI document 'Answers to Questions and Comments on the Japanese Chip Protection Act' presented at the MOSS talks, Tokyo, 26 April 1985.

54 17 USC § 901(b) (Supp. II 1984) defines the 'owner' of a mask work as the person who created the mask work, the legal representative of that person if that person is deceased or under a legal incapacity, or a party to whom all the rights under this chapter of such person or representatives are transferred in accordance with section 903(b); except that, in the case of a work made within the scope of a person's employment, the owner is the employer for whom the person created the mask work or a party to whom all the rights under this chapter of the employer are transferred in accordance with section 903(b).

55 The Japanese concept of 'used for business purposes' is similar to the US concept of 'commercially exploited'. The Japanese have said the concept of 'used for business purposes' is clear from the definitions in Basic Scheme Article 2. The minor difference between Article 1 paragraph 3, item 2 of the

Exclusive rights under the Japanese law are basically limited under three conditions, and are not absolute, as patent rights are. The independent creator of an identical circuit layout may, so long as he has created it originally, also be granted a complete right even though someone has already acquired an exclusive right over the circuit layout. Thus, it is possible under the Japanese law for two 'creators' who come up with the same design, to receive rights to the chip. Moreover, the Act 'shall not extend to the manufacture of a semiconductor integrated circuit which is made by utilising the registered circuit layout for the purpose of analysing or evaluating the semiconductor integrated circuit'.[56] This allows for reverse engineering as does the SCPA.

Finally, these limitations include 'transfer of manufactured integrated circuits', compared to the SCPA concept of first sale.[57] Innocent infringement is allowed under the Act as 'special provisions for a person acting in good faith'.[58]

It is now clear that a registered company has the option to withhold trade secrets under Japan's chip protection scheme. Trade secret protection (special relief) is not provided for in the Act itself, but in a following Ministerial ordinance.[59] These measures are almost identical to those provided for by the US Copyright Office regulations.[60]

Under the US regulations, the registrant claiming trade secret protection may block out portions of the design data to better protect the trade secrets.[61] It is preferable that the Japanese law operates in the same manner to ensure the maximum level of confidence in the security of the proprietary products registered under the law and to encourage companies to take advantage of the law.[62]

Under the Japanese law, no particular provision is written for foreigners, who are technically entitled to equivalent treatment under Japanese law.[63] Thus, protection is extended to all persons, regardless of nationality, whereas the US law is based on the principle of reciprocity. Exclusive rights fall to the creator of a circuit layout or such person's successor.

Notice – Japan

Japan's Basic Scheme contains no discussion of the form of notice, if any, which would be sanctioned by MITI or any indication that the use of a notice such as "M" or Ⓜ or 'T' would provide evidentiary weight that a chip product is protected under the Japanese law.[64] From a practical standpoint, this may be the weakest point of the Japanese Act. A form of notice is obviously needed, and this is one area where uniformity is necessary so that designers are not put in the difficult position of putting a number of varying symbols on a limited printing surface.

Registration – Japan

The Japanese registration process is controlled by the Industrial Property Cooperation Center, a privately funded and staffed organisation set up by MITI.[65] A

Act and section 901(a)(4) and (5) of the US law, as understood, reflects the difference in the law of contracts between the two countries. Article 2 paragraph 3 'Using' in this Act as used with respect to a circuit layout shall mean the following acts:

– the manufacture of semiconductor integrated circuits by utilising the circuit layout;
– the transfer, lease, exhibition for the purpose of transferring or leasing, or the import of semiconductor integrated circuits manufactured by utilising the circuit layout (including goods incorporating such semiconductor integrated circuits).

Section 901(a) of the SCPA in comparison states:

– to 'distribute' means to sell, or to lease, bail, or otherwise transfer, or offer to sell, lease, bail, or otherwise transfer;
– to 'commercially exploit' a mask work is to distribute to public for commercial purposes a semiconductor chip product embodying the mask work; except that such term includes an offer to sell or transfer a semiconductor chip product only when the offer is in writing and occurs after the mask work is fixed in the semiconductor chip product.

56 The Act, Article 12(2). This clause legitimises 'reverse engineering'.
57 The Act, Article 12(3).
58 *Ibid.*, Article 24.
59 See 'Ministerial Ordinance Concerning the Registration of Circuit Layout Rights, Etc.' MITI Ordinance No. 81, promulgated 24 December 1985, Article 7(3) and Article 7(4).
60 37 CFR Part 211.
61 See 'Trade Secret Protection', *Federal Statutory Protection for Mask Works Circular R100*. Washington, DC: Copyright Office.

62 There are now provisions in the Japanese Act for trade secret protection. Initially MITI officials had difficulty with the concept of 'special relief' and how it is applied by the US Copyright Office, claiming that information contained in the deposit materials should have been already made public by the very fact of commercial exploitation (used for business purposes) and usually does not involve any secrecy. MITI document 'Answers to Questions and Comments on the Japanese Chip Protection Act', presented at the Moss talks, Tokyo, 26 April 1985. In a later informal document, submitted to the US Government on 2 May 1985, MITI officials stated their position that 'the nature of the material that is submitted at the time of registration is an important factor in the protection of trade secrets'. The details of the submission were later provided for by a Ministry of International Trade and Industry ordinance after the enactment of the Act, Article 3(3). At present only the Act, Article 38 'Duty to Maintain Secrets' places strict confidentiality requirements on IPCC staff.
63 According to MITI officials, there is no clause in the Act that restricts the rights of foreign nationals. Consequently, the provision of Article 2 of the Civil Code, 'Aliens shall enjoy private rights, except where prohibited by law, ordinance, or treaty', will be applied and foreign nationals will be protected on totally equal terms with Japanese nationals with immediate registration being possible.
64 MITI officials have indicated that a treaty will be necessary in order to have a mask work notice operate in Japan or in other countries as it does in the United States. It is not possible to include provisions regarding the effect of a notice in the ordinances or Cabinet orders when the Act lacks such provisions. The use of a notice, since it is not prohibited under the Act, will probably provide *de facto* evidentiary weight that a chip product is protected under the Japanese law, but the final decision is up to the Japanese courts.
65 The Act Concerning the Circuit Layout, Articles 28 to 46 give detailed provisions for operation of the designated registration organ. They include designation of the registration organ (Article 28), disqualification (Article 29), standards for design

unique aspect of the Japanese semiconductor registration system is the registration organ itself (the Industrial Property Cooperation Center), which is not a government office, but a privately run and funded organisation in which Japan's major semiconductor companies play a significant role.[66]

Like the SCPA, the Japanese Act requires registration within two years of first use for business purposes (commercial exploitation).[67] Under the Japanese law, protection begins on the date of registration under the provisions of the Act rather than on the date of first commercial exploitation, while under the US law protection starts on whichever is the earlier of the two dates. Application for registration for establishment of a circuit layout right must be made within two years of the first commercial exploitation of the circuit layout.[68] Unlike the Japanese Patent Act, there is a minimal examination process (mostly formality checks), and application will be dismissed only in exceptional cases. Registration is also necessary for the transfer of rights, exclusive licensing and certain other matters to be set up against a third party.[69]

Japanese regulation guidelines recommend that some information that only the creator can provide should be given: for instance, the originality of the function of the semiconductor integrated circuit manufactured by utilising the circuit layout in case the creator himself has developed that original function, or important dates in the process of creation such as the date on which the creation started, the date on which the performance of the semiconductor integrated circuit was confirmed through experiment, or the date on which the first sample chips were manufactured.[70]

The US regulations and registration forms require only a brief, general statement that describes the new contribution that is the basis of [the] claim. While the MITI Basic Scheme language suggests that this might be adequate in Japan, there remains some doubt on this issue because of the recommendation that the statement include information such as dates on which research was begun.[71]

Enforcement – Japan

Like the SCPA, The Japanese have rather detailed 'infringement of rights' procedures.[72] However, under the Japanese law infringement may result in criminal punishment, as is the case with all other intellectual property laws in Japan. The holder of a circuit layout right can demand an injunction,[73] in addition to compensatory damages which are recoverable under the provisions of the Civil Code, for any infringement, which is also punishable by imprisonment of up to three years or a fine not exceeding one million yen.[74] These rights include the right to demand discontinuance of infringement, which may entail the destruction of infringing chips.[75] Innocent infringement is well defined also. As in the SCPA, an innocent infringer (person acting in good faith) may be demanded to pay the amount of money which would have normally been received for the use of the registered circuit layout.[76]

Damages are also available from persons who intentionally or negligently infringe on the circuit layout right, up to the amount of profit received, or the amount of money which would have normally been received for the use of the registered circuit layout. However, damages are not limited to any set amount.[77]

tion (Article 30); duty to effect registration for establishment (Article 31); change of office (Article 32); registration business roles (Article 33); suspension and abolishment of business (Article 34); business plans (Article 35); election and dismissal of officers (Article 36); order of dismissal of officers (Article 37); duty to maintain secrets (Article 38); reports and spot inspections (Article 39); adjustment orders (Article 40); annulment of designation (Article 41); entries in books (Article 42); hearing (Article 43); complaint against a disposition (Article 44); enforcement (Article 45); public notice (Article 46).

66 On 16 December 1985, the Industrial Property Co-operation Centre (IPCC) was designated to be the registration organ under the provisions of Article 28 of the Act Concerning the Circuit Layout of a Semiconductor Integrated Circuit. IPCC is an incorporated foundation (public interest juridical person) established on 3 December 1985, with the following two major objectives: (1) research and development, in cooperation with the Patent Office, of a new patent information classification system (the 'F term' search system) for quick and accurate access to patent information and, thereby, promotion of the 'paperless' patent examination; (2) registration of circuit layout rights and other rights pertaining thereto as the designated registration organ in accordance with the provisions of the Act Concerning the Circuit Layout of a Semiconductor Integrated Circuit. The Industrial Property Co-operation Centre was established with contributions estimated at approximately $5 million from private Japanese companies. All staff is sourced from the Patent Agency, and numbers less than 30 employees.

67 The Act, Article 6 'Use of Circuit Layout Prior to Application'.

68 The Act, Article 6.

69 The Act, Article 21.

70 The Act, Article 3 'Registration for Establishment of a Circuit Layout Right'.

71 The provisions of the Japanese Act, unlike those for patents, utility models, designs or trademarks, do not require any substantial examination before registration. In other words, examiners ('performers of the registration business') will only check application forms and attached materials, and will not review them any further.

72 According to MITI officials, the judicial system responsible for the resolution of disputes between private parties under the Act is decided in accordance with the Code of Civil Procedure and other relevant laws. No provisions in the ordinance or Cabinet orders will in any way limit the access to the judicial system.

73 The Act, Article 22.

74 The Act, Article 51.

75 See the Act, Article 22.

76 See the Act, Article 24 'Special Provisions for a Person Acting in Good Faith'.

77 *Ibid*. Articles 25 and 27 define Amount of Salvage and Compensation, respectively. Actions deemed infringement are subject to Civil Code Article 719(1) and Article 724. In a 9 May 1985 letter to Akio Morita, President of the Electronics Industries Association of Japan, an MITI official stated that 'the amount of compensation that plaintiff can collect will be the amount of damage he has been able to prove within the limits of the actual

Further experiences with the Japanese registration system will prove whether these concerns are valid. For temporary reciprocal protection under the SCPA, only 'good faith efforts and reasonable progress towards enacting legislation' must be shown.

The EEC Draft Directive

Most nations with well developed electronics industries recognize that intellectual property protection for semiconductor designs is essential as the world enters the information age. Outside the United States and Japan, movement is taking place internationally on a number of fronts. The European Community is in the process of finalising its draft directive proposal for the legal protection of original topographies of semiconductor producers.[78]

The timetable for passage of the EEC directive is likely to fit well with the interim order expiration date of the US SCPA. The European Community applied on 20 June 1985 for an interim order under which all European semiconductor manufacturers would be permitted to register their semiconductor mask works in the United States under the Semiconductor Chip Protection Act of 1984. The US Semiconductor Industry Association supported the issuance of the interim order, but urged that any order issed should be limited to one year. The European Community originally received a one year interim protection order from the Patent and Trademark Office under the Act, based on its draft directive, which asks all EEC members to pass chip protection laws or protect chips under copyright law. This interim order is scheduled to terminate on 12 September 1986.

The Community is now moving towards enactment of this comprehensive chip protection directive.[79] In early 1986, the Commission of the European Communities submitted a directive for the legal protection of original topographics of semiconductor products.[80] Basically, the Commission's proposal is designed to ensure that integrated circuits and similar semiconductor products are protected in each Member State in accordance with an agreed upon set of common basic principles. Under Community Law, a directive is binding, specifying the result to be achieved, yet leaves the choice of form and methods to the respective national authorities. The directive leaves the decision of how best to protect semiconductor products (that is, through existing copyright law, a separate *sui generis* system, or combination of copyright and specific legislation).[81]

Commission participants have stated that 'this framework approach seems necessary since the legal starting points of the Member States are very different, while results need to be achieved quickly if the exercise is to achieve its objectives, in particular, continued protection for Community producers in the United States markets'.[82] Requests for renewal of the interim orders of protection granted under section 914 of the SCPA will have to be filed for all Member States, except the United Kingdom, in the summer of 1986.

To a great degree, the proposed EEC directive is similar to the US SCPA. The directive specifies that the subject matter to be protected is the 'topography' of a 'semiconductor product', in comparison to the SCPA which utilises the term 'mask work' or the Japanese system which focuses on 'circuit layout'.[83] This definition, like the SCPA, covers the configuration of the product itself as well as other expressions of the configuration in the form of masks, drawings, or computer coding.[84]

Two major concerns with the earlier EEC draft directive raised by observers in the United States were those of deadlines for Member State legislation implementation, and provisions on reverse engineering. Those concerns have been for the most part resolved by the latest draft

damage he has suffered, according to Article 709 of the Civil Code. Case laws developed along the Patent Act and the Copyright Act will provide reference for the computation of actual damage'.

78 Commission of the European Communities, Proposal for a Council Directive on the Legal Protection of Original Topographies of Semiconductor Producers, Brussels, 23 December 1985, COM(85)77 final.

79 Community Laws can take different forms having different effects, the main distinction being between a 'directive' which the Commission has proposed for semiconductors and a 'regulation'. Regulations are directly applicable in the sense that they require no further implementation after their adoption by the Council and entry into force. They can then be relied upon by citizens in all courts at national and community levels. 'Directives', on the other hand, are addressed to the Member States and impose obligations under Community Law on the Member States to make their national laws conform with the rules of the directive within a particular time frame. Subject to certain qualifications not relevant in the present context, directives cannot be relied upon by citizens in legal proceedings before national courts where the national law is not in conformity with the directive.

80 See also 'European Commission's Proposal on Legal Position of Semiconductor Products', in *Patent, Trademark and Copyright Journal* 13 February 1986 (Volume 31, No. 767) at 298 hereafter known as Commission Proposal.

81 Commission Proposal, Article 2(2) provides that 'exclusive rights may be conferred by the provisions of national copyright laws, by provisions enacted for the specific purpose of protecting the topographies of semiconductor products, or by a combination of these provisions'.

82 See 'News and Comment: Foreign Laws' in *Patent, Trademark and Copyright Journal* (Volume 31, No. 767) 13 February 1986 at 289.

83 The term topography is defined as a series of related images, however fixed or encoded, representing the three-dimensional pattern of the layers of which a semiconductor product is composed, and, in which series, each image has the pattern or part of the pattern of the surface of the semiconductor product in its final or any intermediate form. Commission Proposal, Article 1(3).

84 The Japanese law defines 'circuit layout' as 'a layer of circuitry elements and lead wires connecting such elements in a semiconductor circuit'. In the absence of a clear statutory definition, a 'circuit layout' may be any number of things – a simple schematic drawing, a scale model of an electronic component, or even the architecture of a chip. The EEC directive definition of a 'topography' covers the configuration of a product as embodied in the product itself as well as other expressions of the configuration in the form of masks, drawings, or computer coding.

proposal. Reverse engineering will be provided for, and as stated in the Directive, Member States must comply with the directive by 1 October 1987.[87]

Exclusive rights – EEC

The EEC Directive includes provisions for reciprocal consideration of foreign mask works. Exclusive rights would normally fall to any creator of a topography who is a national and resident of a Member State and would last for a period of ten years.[88] An analysis of the EEC Directive shows its similarities to the SCPA, while the flexibility to allow for varying Member State law is maintained. Article 2(3) states that those topographics that are not 'original' are not subject to protection.[89]

Protection is extended to all Member States, regardless of the legislative approach adopted. Those entities protected are listed in paragraph 1 as being any creator of the topography who is a national and a resident of a Member State 'and their successors in title'. As with the reciprocity provisions under the SCPA, protection within the EEC Member States can be extended to persons who are not residents of a Member State, 'in accordance with decisions to be adopted by the Council acting by qualified majority on a proposal from the Commission'. Decisions are to be based on the condition of reciprocity.[90]

The right to reproduce the topographies in whole or in part, sell, rent or lease or import the topographies or semiconductor products manufactured using the topographies is also conferred.[91] These rights will not apply to any act committed after the topography has entered the market in a Member State.

Reverse engineering is also clarified. Under the directive, reverse engineering authorises reproduction for the purpose of 'analysing, evaluating or teaching the concepts, processes, systems or techniques embodied in the topography or the topography itself'.[92] But like the US law, the directive places the burden of proof on the party commercially exploiting the results of reverse engineering. In practice, once a degree of similarity between two topographies is shown, someone relying on the reverse engineering defence will find it necessary to prove that his creation is an original creation, created through the use of reverse engineering. In this scenario, a 'paper trail' must be provided to establish the defence of creativity.

Registration – EEC

The EEC will leave registration procedures to the discretion of the Member States. As in the SCPA and Japanese Act, under the EEC Directive, protection will only apply if the topography is registered within two years of first commercial exploitation.[93] And in the same manner as the SCPA, Member States may require the deposit of identifying material.[94] However, it may be assumed that provisions regarding the deposit of trade secret material may be left to the discretion of the Member States.[95]

85 Commission Proposal, Article 10(1).

86 Commission Proposal, Article 6(1). The Commission Proposal has been drafted to allow for chip protection in a *sui generis* or copyright format. Thus there is an allowance for flexibility in the term of protection. Article 6 provides that:

> (1) The exclusive rights to which reference is made in Article 2 shall come to an end on a date at least ten years from the date on which the topography is first commercially exploited or, where registration is a condition for the subsistence of protection, from the date on which the topography is first commercially exploited or the date on which it is registered, whichever is the later.
>
> (2) The exclusive rights shall come to an end not later than fifteen years from the date on which the topography is first fixed or encoded. This provision shall be without prejudice to rights conferred by the Member States in fulfilment of their obligations under the Berne Convention for the Protection of Literary and Artistic works and the Universal Copyright Convention and to corresponding rights conferred on a Member State's nationals or persons resident on its territory.

87 Commission Proposal, Article 2(3) provides that:

> the topography of a semiconductor product shall not be protected unless it satisfies the condition that it be original in the sense that it is the result of its creator's own intellectual effort. Where the topography of a semiconductor product consists of elements that are commonplace in the semiconductor industry, it shall not be considered original unless the combination of such elements, taken as a whole, is original and not commonplace.

88 Commission Proposal, Article 3 provides that:

> (1) Protection shall apply at least in favour of natural persons who are the creators of the original topographies of semiconductor products and who are nationals of and resident in a Member State and their successors in title.
>
> (2) However, where Member States provide for registration in accordance with Article 4, they may alternatively provide that protection shall apply at least to persons registering original topographies who are nationals and residents of a Member State or companies and firms within the meaning of...
>
> (3) Member States shall extend protection to persons who do not qualify for protection under paragraphs 1 or 2 in accordance with decisions to be adopted by the Council acting by qualified majority on a proposal from the Commission.

89 Commission Proposal, Articles 5(1)(a) and 5(1)(b).

90 Commission Proposal, Article 5(2) and 5(3) provides that:

> The exclusive right to authorise reproduction of the topographies shall not apply to reproduction for the purpose of analysing, evaluating or teaching the concepts, processes, systems or techniques embodied in the topography or the topography itself. The exclusive right to authorise the acts specified in paragraph 1 shall not extend to any such act in relation to an original topography created on the basis of any analysis and evaluation of another topography carried out in conformity with paragraph 2. Where the topography of a semiconductor product consists of elements that are commonplace in the semiconductor industry, it shall not be considered original unless the combination of such elements, taken as a whole, is original and not commonplace.

91 Commission Proposal, Article 4(1).

92 *Ibid.*

93 In a presentation at the office of the US Trade Representative (15 April 1986) R. J. Coleman, Head of Division, Intellectual Property and Unfair Competition, Commission of the European Communities, stated that there is mixed opinion within the Community with regard to the creation of formal registration systems. The majority in the industry feel that a formal registration system is unnecessary as private companies can provide proof of originality at less cost. Others, particularly those involved in developing new products, feel [illegible]

Notice

In one respect, the Directive differs from the SCPA. Whereas notice of mask work protection under the US law is provided by a capital M in a circle or "M", notice is provided for under the directive by a capital 'T' in a circle.[94] This is one area where uniformity is necessary so that designers are not put in the difficult position of having to print both US and EEC symbols on the silicon chips.

Enforcement

The EEC Directive has yet to clarify the extent of remedies for knowing infringement.[95] As in the United States under the SCPA, innocent infringers (that is, one who purchases, unknowingly, a semiconductor product whose manufacture infringed its reproduction rights), are subject only to royalties.[96] When innocent infringement does occur, 'the Member States may subject the acts specified to the payment of royalties'.[97]

WIPO Treaty

WIPO draft treaty

Because the US and Japan have adopted a *sui generis* form of chip protection, the treaty approach for extending protection internationally that was contemplated by the US law would not be satisfied by existing intellectual property treaties. Perceiving the need for a new treaty, WIPO has prepared a draft of a proposed treaty that would provide an international convention under which mask works could effectively be protected internationally through national laws of treaty members. This was developed by the WIPO staff with input from six semiconductor manufacturers from various countries, including the US and Japan.

The treaty consists of three major parts. The first part, Article 2, requires each treaty member to grant to nationals of other Member States the same mask work protection that it grants to its own nationals. The second major part, Articles 3 to 5, sets forth the minimum protection and maximum formalities that must be present in a country's law before the country can join the treaty. The last part, Articles 6 to 11, deals with the administration of the treaty.

The multinational treaty approach to international protection can have advantages over multiple bilateral reciprocal agreements. Reciprocal agreements may be the best way to ensure an appropriate level of minimum standards in key countries. However, once a consensus exists on the elements for adequate protection of intellectual property rights, a treaty can be used to extend that consensus internationally. Moreover, the treaty approach has been used successfully for other forms of intellectual property protection.[98]

On 26 to 29 November 1985 the Committee of Experts on Intellectual Property in Respect of Integrated Circuits met at the World Intellectual Property Organization in Geneva. The purpose of the meeting was to discuss the draft treaty, with the hope of implementing a binding document for the international protection of integrated circuits from copying and other forms of piracy. A draft multilateral treaty (the first ever produced) was submitted for this purpose by WIPO's Director-General. The draft was well received, but will require much strengthening.[99]

useful mechanism. Questions on both sides exist as to what extent the registration material would be made accessible to the public.

94 Given the limited amount of surface space on semiconductors, this may cause problems for those chips being registered in both the US and the EEC. Commission Proposal, Article 6 provides that, where the legislation of Member States provides that semiconductor products manufactured using protected topographies may be distinctively marked, the mark to be used shall be capital T in a circle.

95 A pirating party would be subject to national law.

96 Commission Proposal, Article 5 provides that:

> (4) ... the exclusive right to authorize the acts specified in paragraph 1(b) shall not apply to any such act:
> (a) committed after the topography or the semiconductor product has been put on the market in a Member State by the person entitled to authorize its marketing or with his consent; or
> (b) committed by a person who has purchased a semiconductor product without reasonable grounds to believe that its manufacture infringed the exclusive right specified in paragraph 1(a).
>
> (5) Where paragraph 4(b) applies, the Member States may subject the acts specified in paragraph 1(b) to the payment of royalties.

97 Community law does not normally include provisions on penalties. This would result in an incursion on Member State civil and criminal procedure. Instead Article 5 of the Treaty of Rome provides that:

> Member States shall take all appropriate measures, whether general or particular to ensure fulfilment of the obligations arising out of this Treaty or resulting from action taken by the institutions of the Community. They shall facilitate the achievement of the Community's tasks. They shall abstain from any measure which could jeopardise the attainment of the objectives in this Treaty.

Thus, the same laws which would apply are those normally used in the fields of patent and copyright law.

98 The development of a separate treaty to protect mask works fixed in semiconductor chips rather than amending existing conventions such as Berne or the Paris Union, for example, is the proper approach. Opening existing treaties for revision is cumbersome and creates the risk that undesirable extraneous changes will be made when chips are added. The administrative burden could also be high, since for example, modifications to Berne require unanimous approval of all Berne members whether or not they are interested in protecting chips. The current attempt at modifying the Paris Convention is also already politically complicated and should not be complicated further by attempting to add chip protection. Therefore, it is clear that the best approach is a *sui generis* treaty for chip protection.

99 The programme of WIPO for the 1984 to 1985 biennium, under the title 'Computer Programs, Including Integrated Circuits', provides that 'The International Bureau will continue to study the usefulness and feasibility of an international treaty providing for the protection of computer programs (including *integrated circuits*) against unauthorised exploitation for a limited period of time ...' (document AB-XIV/2, Annex V, item PRG 03(2), emphasis added). This was proposed by the Director-General of WIPO in June 1983, and WIPO's Governing Bodies approved it in September 1983.

The draft treaty differs from the US Semiconductor Chip Protection Act on a number of points. Questions were raised concerning the standards in the draft treaty – whether they ensured an adequate level of protection for semiconductor mask works, and whether the Treaty provided for a mechanism to monitor the actions of signatories in implementing the agreement and ensuring effective enforcement and dispute settlement.

Overall, the outcome of the November conference in Geneva was favourable. A number of topics for discussion were presented by the US delegation. These included the following points: the subject matter of the Treaty (integrated circuits) should be defined; the standard of 'originality' should be specified; certain terms such as 'commercial exploitation' and 'design' or 'layout' should also be defined; the relationship between the draft treaty and existing patent and copyright treaties should be clarified; the scope of the exclusive rights and permissible limitations, especially the right of importation and the limitations regarding the defences of innocent infringement and reverse engineering should be clarified.

Of particular interest were the enforcement and dispute settlement (consultation) proposals put forward by the US delegation, which were generally well received.

Other concerns were raised, such as the need for inclusion of a provision for an optional notice of protection having evidentiary significance; the commencement of the term of protection and the assurance of a right to reasonable compensation starting from either commercial exploitation or registration should be more clearly specified; the treaty revision process should be regulated in greater detail; and provision for consultation procedures to encourage the negotiation and settlement of different opinions about treaty obligations should be considered.

The discussion also centred on the issues of non-voluntary licences, registration of claims, duration and start of protection, the grace period, and compatibility with existing conventions and with the European Economic Community Directive.

WIPO is now preparing a revised draft taking into account comments from the Committee which will be examined by the group in the summer of 1986.[100] Those active in the Committee hope that a text will be cleared for adoption and signature at a diplomatic conference in early 1987.

Summary – Reciprocity under the SCPA

Historically reciprocity has meant 'an approximate equality of concessions accorded and trade benefits received among or between participants in a negotiation'.[101] Reciprocity is not a new principle, but has since the Trade Agreements Act of 1934 traditionally been a basic objective of US trade negotiations and a critical measure of their success. Reciprocity is a concept equally important to the protection of semiconductor mask work designs. In its drafting of the Semiconductor Chip Protection Act, Congress attempted to create a new system of intellectual property protection, which would be applicable to foreign works on a basis of reciprocity.

On 19 May 1985 the Commissioner of Patents and Trademarks extended the interim orders issued for Japan, Sweden, Australia and Canada to coincide with the expiration date of the European Community's interim order.[102] A hearing was set by the Patent and Trademark Office for 9 July 1986, at which time specific features of national legislation will be reviewed. The Patent and Trademark Office felt that since detailed information on specific features of the proposed national legislation was not available, the holding of a public hearing to permit a full airing of views would be appropriate.

Since the enactment of the SCPA the Semiconductor Industry Association[103] has promoted the issuance of interim orders under section 914, rather than the unconditional issuance of irreversible Presidential Proclamations.[104] It is the Semiconductor Industry Association's position that protection of foreign nationals' mask works through the extension of interim orders should continue indefinitely until all countries receiving protection under current interim orders allow an equivalent level of protection, ideally through a binding international treaty. Presently, all of these countries are actively working in the WIPO forum to pursue the negotiation of a new treaty for the protection of semiconductor chips.

The roll-over of interim orders prior to the comprehensive international treaty being in place would have the distinct advantage of preventing a 'Balkanisation' of national chip protection systems, with nations offering varying forms and levels of protection all receiving permanent protection in the United States via a Presidential Proclamation.

The extension of section 914 interim orders also has a number of other advantages. Section 914(a) allows the Secretary of Commerce (that is, the Patent and Trademark Office) to initiate a section 914 proceeding at any

100 The Committee of Experts on Intellectual Property in Respect of Integrated Circuits will be convening in Geneva, 23 June to 27 June.

101 See R. Michael Gadbaw, 'Reciprocity and Its Implications for US Trade Policy', in *Law and Policy in International Business*, [1982] Volume 14, No. 3, at 691 to 746.

102 See Patent and Trademark Office, 'Extension of Previously Granted Interim Orders Under the Semiconductor Chip Protection Act of 1984', in Federal Register, 19 May 1986, (Volume 51, No. 96).

103 The Semiconductor Industry Association (SIA) is a United States trade association representing 52 manufacturers of semiconductors who together produce over 95 per cent of all semiconductors fabricated in the United States each year. SIA was instrumental in the passage of the Semiconductor Chip Protection Act in 1984.

104 The Patent and Trademark Office's statutory power to extend interim orders under section 914 expires on 8 November 1987. However, SCPA section 914(f)(2) directs the Secretary of Commerce, in consultation with the Copyright Office, to report to Congress in November 1986 on actions taken under section 914 and on possible modifications to sections 914 and 912(a). The extension of section 914 beyond the 8 November 1987 deadline should be raised at this time.

time, and permits 'any person' to petition for such a proceeding. The hearing in a section 914 proceeding allows for an important interchange of ideas, and public comment on behalf of the Government of the country receiving protection, and the US semiconductor industry.

The 'all or nothing' deadline pressure that exists under a section 902 proclamation is removed, allowing all interested parties the opportunity to evaluate the development of their national laws, which is in all cases a time-consuming process.

Finally, section 914 procedures are inevitably much faster than section 902(a)(2) procedures, as there is no Cabinet or White House determination in a section 914 proceeding, and the reciprocal rights are the same as those offered under a Presidential Proclamation.

Thus, the use of section 914 instead of section 902(a)(2) should not be looked upon as an action of opposition to the protection of foreign mask works within the United States. In actuality, it is an acknowledgement of the complexity of the new legal area of semiconductor design protection, and the problems that may result from decision-making under time constraints.[105]

The reciprocity provisions of the SCPA seem to have been effective. Chip protection systems have been set up in the US and Japan, and the EEC and WIPO are currently refining their draft directives. WIPO is actively developing a multilateral chip protection treaty which may have far-reaching effects on the development of chip protection regimes in all nations.

Overall, the SCPA has been effective in doing what it was designed to do, protecting chip designs from pirating. As national legislation is enacted, a number of nations may be granted permanent protection in the United States under the reciprocity provisions and the SCPA. As in many areas of law, domestic laws are developing and converging on a multilateral scale, and in a few years all nations with substantial informatics industries will most likely have comprehensive semiconductor chip protection regimes in place.

105 See R. Stern, *Semiconductor Chip Protection*, Harcourt, Brace, Jovanovich: Law and Business, 1986, at 414 to 417.

RESPONSE TO WRITTEN QUESTIONS

Mr. Gadbaw, during the February 26, 1987 hearing, we discussed the limitations of extending the authority granted to the Secretary of Commerce under section 914 for an indefinite period as well as limitations of extending that authority for a time certain. Perhaps there is a compromise between the two. What is your opinion of legislation that would extend indefinitely the Secretary of Commerce's authority to issue Section 914 proclamations, but that would prohibit the Secretary from issuing any individual interim order for longer than eighteen months. Do you agree that such a solution would offer protection, eliminate the need for Congress to revisit this issue every three years, and enable the Patent and Trademark office to regularly scrutinize a nation's "good faith efforts"?

Mr. Chairman, SIA supports the extension of the authority granted to the Secretary of Commerce for as provided in S. 442. A limited extension is appropriate. The three years provided in S. 442 should allow the necessary time for other countries to enact such legislation.

SIA believes it was the intent of Congress to utilize Section 914 as an interim form of protection. Section 914 was designed to have few restrictions -- to encourage other nations either to enact chip protection laws that would meet the standards for the issuance of a Section 902 Presidential Proclamation, or to become a signatory to an international treaty.

We feel that at present, the development of chip protection legislation in other nations necessitates the extension of Section 914. However, an indefinite extension of Section 914 would send the wrong signal to other major semiconductor producers -- namely that interim protection could be provided indefinitely. The current limited role of the Section 914 transitional provision in raising the priority of mask work protection would be reduced.

However, SIA would not be opposed to the limitation of Section 914 orders to 12 months. With the exception of the U.K. interim order, the Patent and Trademark Office has developed a practice of generally issuing interim orders for a period of one year. We feel that required annual hearings as a part of Section 914 reviews would continue to assist in moving the legislative process along in other countries at a pace which might otherwise not be possible.

REILING/GADBAW

YOU MENTIONED THAT YOU ASKED THE ADMINISTRATION TO WORK WITH THE JAPANESE ON AN AGREEMENT ON THE MUTUAL RECOGNITION OF CHIP REGISTRATION. COULD YOU ELABORATE ON WHAT IT IS THAT THE SEMICONDUCTOR INDUSTRY IS LOOKING FOR?

Mr. Chairman, in our discussions with U.S. Government representatives to the sessions of the WIPO Committee of Experts on Intellectual Property in Respect of Integrated Circuits, we suggested that the United States raise the issue of reciprocal recognition with the Japanese and the European Community. What this means is that a registration in one country would automatically be considered valid in the other. The concept of reciprocal recognition has a precedent in the Berne Convention, and has the inherent benefit of creating a de facto multilateral or bilateral registration system for U.S. designs, equivalent to that provided by the SCPA.

Although we are hopeful that the final WIPO draft treaty will be acceptable to the U.S. semiconductor industry, in the event that an international treaty takes longer than expected, such a system would promote the international comity objectives of the SCPA. Provided that the major semiconductor consuming nations enter into such an arrangement, a higher level of protection for U.S. designs may be achieved through a reciprocal recognition framework than could be obtained via a multilateral treaty.

BEFORE A NATION RECEIVES A PRESIDENTIAL PROCLAMATION PURSUANT TO SECTION 902, ITS NATIONALS PROBABLY WOULD HAVE ENJOYED PROTECTION PURSUANT TO A SECTION 914 INTERIM ORDER. YOU NOTED THAT THE PROCEDURES THAT ARE FOLLOWED BEFORE ISSUING A SECTION 914 PROCLAMATION ENABLE THE U.S. INDUSTRY TO REVIEW AND COMMENT ON THE EVOLUTION OF THAT NATION'S LAW. YOU ALSO

OBSERVED THAT THE SECTION 914 HEARING PROCESS HAS BECOME A FORUM FOR THE DISSEMINATION OF INFORMATION AND THE EXCHANGE OF VIEWS ON THE VIABILITY OF A NATION'S LAW.

WHAT DO YOU THINK THOSE NEGOTIATING SECTION 902 PROCLAMATION WILL LEARN BY GIVING YOU A SECOND OPPORTUNITY FOR COMMENT?

Mr. Chairman, there is a strong consensus among most observers that the Section 914 hearing process has become an important forum for the international dissemination of information and the exchange of views on the appropriate form and terms of protection for semiconductor designs. Given the permanence of a Section 902 proclamation, it is an inherently more important process. SIA feels that the policy of openness to public comment should be continued in the Section 902 process.

The opportunity for comment in the Section 902 process would allow for a necessary focus on the" national treatment" and "substantially similar" standards for a Section 902 proclamation -- standards which are completely different from those found in Section 914. Given the complexity of this new legal area of semiconductor design protection, opportunity for public review in the Section 902 process becomes essential.

I WOULD LIKE TO HEAR YOUR VIEWS ON JUST HOW OPEN THIS PROCESS SHOULD BE. FOR EXAMPLE, SHOULD THE SECRETARY OF COMMERCE OR THE SECRETARY OF STATE BE REQUIRED TO CALL IN A REPRESENTATIVE OF A FOREIGN GOVERNMENT BEFORE THE PRESIDENT ISSUES A SECTION 902 PROCLAMATION? WOULD IT BE ENOUGH IF THE

REGULATIONS PROVIDED AN OPPORTUNITY FOR COMMENT TO ANY INTERESTED PARTY BEFORE THE SECRETARY ENGAGED IN SERIOUS NEGOTIATIONS WITH OTHER NATIONS?

Mr. Chairman, it is the view of the Patent and Trademark Office in the Report on the Operation of the International Transitional Provisions of the Semiconductor Chip Protection Act of 1984 of November 7, 1986 that the Section 902 process should be diplomatic in nature and should be conducted on a government-to-government basis. The Patent and Trademark Office has suggested further consultations with representatives of concerned U.S. rightsholders as a part of these government-to-government consultations.

We recognize that government-to-government consultations will be an integral part of any Section 902 proceeding. SIA welcomes government-industry consultations as a part of the Section 902 process. However, given the importance of the Section 902 process, and the benefits of public hearings shown in the Section 914 process, we believe that the optimal solution is to amend the SCPA to ensure that public hearings are included as a part of any Section 902 review.

We do not feel it would be necessary for the Secretary of State or Commerce to specifically call in a foreign government representative prior to the issuance of a proclamation. However, we do feel it is necessary for a representative of the foreign government requesting permanent protection via a Section 902 proclamation to provide information that would be available to interested parties in the context of a public hearing.

Senator LEAHY. Thank you. You know, I agree with you when you say that the policy of openness and public comment in Section 914 should carry over into the issuance of a presidential proclamation. You suggest that the procedures of our trade laws serve as a model for it. There is no similar procedure, though, for presidential proclamations issued pursuant to Section 104 of the Copyright Act. If we establish notice and comment procedures under Section 914, how do you reconcile the differences between these two intellectual property laws?

Mr. REILING. I do not know if you can. It is borrowing from each one.

Senator LEAHY. Incidentally, you stated that the Semiconductor Industry Association has supported the granting of reciprocal rights to Japan under Section 914, but does not favor the granting of a Section 902 presidential proclamation because of the uncertainty inherent in the Japanese registration process. I assume you mean if the U.S. grants a presidential proclamation and then Japan stopped registering U.S. chips or otherwise stopped treating our chips as the law requires, we have given up our leverage to persuade them to follow the line?

Mr. REILING. That is absolutely right.

Senator LEAHY. Could not the President revoke his Section 902 presidential proclamation if he wanted to?

Mr. GADBAW. He could, at least in theory. In practice, Senator, it is virtually impossible to get the President's attention to revoke a proclamation. It is for that reason that we find the presidential proclamation process a very inflexible one, and not the kind of mechanism that allows us to keep day by day, month by month scrutiny over what other countries are doing.

There is an alternative. That is—if there were an agreement by which there were mutual recognition of registration between the United States and Japan and other countries, such that if a chip were registered in the U.S., that registration is recognized by Japan. That would meet our concerns with the Japanese law in this area.

Senator LEAHY. Have the Japanese developed their own manufacturing techniques and facilities so superior to ours that it is really too late for the U.S. industry to catch up, let alone leap frog them?

Mr. GADBAW. I do not believe so, Senator. I think in a number of areas, the Japanese have shown a tremendous ability to catch up and even exceed us in key areas of the technology, but we still very much feel that the U.S. industry is competitive and can continue to be competitive over the long run. There are certain things that the industry has to undertake, which it is currently addressing but that in fact we think we very much have a competitive industry and can continue to have one.

Senator LEAHY. What do you think about that, Mr. Ferguson?

Mr. FERGUSON. I think that we are in very grave trouble and that unless we take really quite drastic and serious steps, the American semiconductor industry, or most of it, will essentially disappear. Even companies such as Digital and IBM, which produce circuits internally, will be unable to remain competitive with the Japanese if they are unable to buy superior or at least competitive

capital equipment. The capital equipment industry is going away as fast as the semiconductor industry is.

Senator LEAHY. Is the Japanese government or the Japanese semiconductor industry out to destroy American industry or are we doing it to ourselves, or is it both?

Mr. FERGUSON. It is both. It is both. We labored for too long under the illusion that no one could possibly compete with us and we are paying for it now. Also, however, the Japanese—and these are not small corporations that are doing this—have devoted enormous resources to obtaining equality and eventually superiority in this technology.

Senator LEAHY. Do you see the government and the industry in Japan really out, as a direct goal, to flatten us?

Mr. FERGUSON. I do not think that they would object to that result.

Senator LEAHY. Do either of you gentlemen want to agree, disagree or add to that?

Mr. REILING. To the objective of the Japanese government?

Senator LEAHY. Yes.

Mr. REILING. I think it is a published record that they decided that they would like to become a dominant force in the information age and that the way to do that was to try and capture the semiconductor industry, first.

Senator LEAHY. I will go back to Mr. Ferguson and I will ask again, as I have the other panels, some very specific questions on some very specific parts of the law, but I am intrigued by this area.

Mr. Ferguson, is there anything that we can do about the state of the U.S. semiconductor industry. Do we just roll over? Have we lost a generation? What do you suggest?

Mr. FERGUSON. Well, I think there is a great deal that can be done. I have not decided to approximately move to Japan and live there for the rest of my life. I am very much committed to being American. I think that———

Senator LEAHY. Land values in Cambridge have not skyrocketed that much, yet.

Mr. FERGUSON. I am not yet a landowner. My mother is in California and I hope that Silicon Valley can remain a healthy place for some time to come.

I think that redressing the losses that we have suffered and maintaining our competitiveness in this area will require, however, enormous resources and significant changes in the conduct both of private industry and of various portions of the United States Government. I think the proposed Sematech effort, for example, is commendable in a number of respects but I have two concerns about it. One is that if the Department of Defense brings to this effort the same managerial capacities that you referred to in discussing the B-1 Bomber, we might as well give up.

The second concern I have is that it actually is a very small step relative to what we have to do. The commitment is required in a number of areas, not just in funding R&D, but in many others, including engineering education, are really quite massive. Japan now graduates as many or more electrical engineers as we do, despite the fact that their population is only half of ours.

Senator LEAHY. Either of you gentleman want to add your suggestions as to what we should do?

Mr. GADBAW. I think I would agree completely with what Mr. Ferguson has said, that nothing short of a change in our national priorities is called for. I think that in many ways, if one looks at developments over the last several years, including the efforts that you Senator have put in to adapting our laws and making the federal government more aware and attuned to the needs of a healthy high technology sector, indicate that there is a recognizable change in our national priorities but that much needs to be done, as Mr. Ferguson has said, both by the federal government and by the industry.

Senator LEAHY. Is Sematech the direction to go?

Mr. GADBAW. I think it is one solution. I think it is a step in the right direction. I think it is still a little premature to say whether that particular venture will be able to get off the ground. I think the industry has shown considerable commitment to the concept to date. The industry is trying to come to grips with the issues that are involved in launching that type of an ambitious venture, but I personally am quite optimistic that something like Sematech will, in fact, address the kinds of concerns that Professor Ferguson has identified.

Senator LEAHY. You heard the discussion we had before about who gets the proprietary rights to those intellectual properties, which is something that we may at some point have to spell out in legislation. I know it is a concern of Senator DeConcini, too.

Those patents, those copyrights, those secrets that are developed by a manufacturing consortium that is getting most of its funding from the Department of Defense. Who gets those, in your estimation? You deal with the question of proprietary rights all the time in your own company.

Mr. REILING. I think the proposal for funding Sematech is both industry and governmental and I suppose it is going to be a very intricate web of who is funding the R&D and therefore, having rights to it. Certainly, the need for a viable U.S. semiconductor industry is as important to the commercial businesses of the United States as it is to the Defense Department. We must minimize, in my opinion, the governmental regulation or restrictions that are put on this technology.

Senator LEAHY. In the modeis you have seen of the Sematech proposal, is this kind of regulation or restriction minimized or increased?

Mr. REILING. The analogy that I have heard used is to the VHSIC program, which had almost total government funding and has severe restrictions placed on it. This seemed to inhibit the commercialization of those products.

Senator LEAHY. I do not want to put words in your mouth but are you saying that this venture makes sense only if the effort is made to ease those kinds of restrictions? In other words, to allow the commercial application?

Mr. REILING. Absolutely.

Senator LEAHY. And does that go to the extension of licensing foreign manufacturing?

Mr. REILING. Well, certainly the objective is to develop a strong U.S. industry and therefore one has to act accordingly.

Senator LEAHY. I take it that you are not jumping in eagerly to license those foreign manufacturers?

Mr. REILING. That is true.

Senator LEAHY. Professor Ferguson, what does it cost to build a semiconductor production facility in the United States? I realize that is a broad question but I would like to know how it compares to construction costs in Japan and Korea.

Mr. FERGUSON. My understanding is that, and my understanding I should say is imperfect because I am not an expert on the construction aspects of semiconductor technology, but my understanding is that the Japanese and Koreans have been able to build semiconductor factories at about three quarters the cost and in less than half the time that it typically takes a United States company to build a roughly equivalent factory.

In fact, IBM's newest semiconductor facility in East Fishkill is being built by Shimizu, a Japanese construction company. IBM is not happy about this, I might add.

Senator LEAHY. They should have used their facility in Vermont.

Mr. FERGUSON. That one is doing fairly well.

Senator LEAHY. Three quarters of the cost but about half the time. That is the part I find extraordinary. The three quarters the cost I can see, considering the difference in labor costs and certain materials costing the same. But half the time? Why half the time?

Mr. FERGUSON. Because I think, and here I should say that my views in this matter are somewhat controversial and certainly are not shared by everybody in the industry. I think that for a long time the United States industry has been dangerously fragmented and we have not developed as a whole, as a nation, as an industry the long term, large scale complex enduring institutions and managerial capabilities that are needed to act in this industry.

I think that one issue, in regard to Sematech and other potential government assistance to the industry is whether it will be disbursed over hundreds of small entrepreneurial firms or whether there will be some route—a consortium is one route and large companies is another route—for channeling the money in such a way that it is used productively and does not go into redundant efforts.

Senator LEAHY. Do you see that changing? You have obviously studied it. You say your views may be controversial in the industry, but if they are then I would hope that would mean that you have also been discussing them and debating them with other members of the industry. Do you see change?

Mr. FERGUSON. Yes, there is change. And unfortunately, over the past 5 years, the primary source of change has been the fact that a high fraction of the smaller American semiconductor companies have simply gone bankrupt as a result of Japanese competition.

There is, however, a concentration in the industry and I think that the industry has begun to recognize the need for cooperation and for large scale development in manufacturing efforts.

Senator LEAHY. If they do not make these changes, is there any way that in a decade or 20 years from now, then we will even begin to be competitive with Japan?

Mr. FERGUSON. Unless these changes are made, I think that the industry will lose competitiveness within 5 years and within 10 years I think most of the industry will be gone, literally gone.

Senator LEAHY. And then we will be in the position of relying on foreign manufacturers and foreign suppliers?

Mr. FERGUSON. Yes, that is correct.

Senator LEAHY. And then also, in turn, is it an overstatement to say that as we want to develop new products requiring this kind of technology that foreign manufacturers and suppliers will be able to determine whether to sell us the tools required to develop such new products.

Mr. FERGUSON. Yes, that is correct and I think that there have recently been signs that that process is already underway.

Senator LEAHY. Can you give me an example?

Mr. FERGUSON. There are certain classes of high speed components in which three or four Japanese companies now have 80 to 100 percent of the entire world market. Also, some very arcane capital equipment technologies and several large companies have reported to me in private that they have had extreme difficulties obtaining these components in these capital equipment technologies. In some cases, they have simply been unable to obtain them.

Senator LEAHY. Do the Japanese companies act in concert when deciding to limit our access to some technologies? If so, is it solely an industry determination or is it an industry-government determination?

Mr. FERGUSON. It is a little bit of each, but in my experience—which again, in this area, is limited and relies primarily upon what people tell me rather than what I know directly—my understanding is that even individual companies in Japan, without coordinating with other companies can sometimes behave this way because a company like Hitachi, for example, is a $30 billion company. Their semiconductor sales are perhaps 10 percent of their total sales. They are much more interested ultimately, over the long term, in the computer industry and the telecommunications industry and if they can withhold semiconductor components or capital equipment technologies from the United States manufacturers, they will strengthen their long term position in these other downstream markets, which are ultimately much larger.

Senator LEAHY. I am still sitting here a little bit shocked by your five year projection. Once, in playing Trivial Pursuit, I was asked what the shortest measurable period of time was. I said that is very easy. A 6-year Senate term if you are the one serving it. I have got now a little over 5 years left in this one, so it focuses my attention a little bit.

What does your 5-year projection mean to the computer systems industry?

Mr. FERGUSON. Well, I think that we have already begun to see some evidence of the process, but in general what will happen to the computer systems industry and other so-called downstream industries, which depend upon semiconductors, will happen a bit later than what happens to the semiconductor industry. So when the Japanese are, shall we say, firmly in control of the semiconductor industry, they will begin to withhold technology or include their best technology in computers and telecommunications sys-

tems that they make and sell. That will begin to show up somewhere between three and seven years from now.

Senator LEAHY. By downstream you mean everything from toys to automobiles?

Mr. FERGUSON. Yes. My understanding—and again, my understanding is very imperfect—is that there is a linkage to the defense process in this because Japanese firms which have superior commercial technologies are sometimes reluctant to provide them to American companies for fear that they will be used in commercial competition, even if they have defense applications.

Senator LEAHY. You also described the semiconductor industry as parochial. Do you want to expand a little bit on that, and I am going to turn to the other two gentleman for their responses to this question.

Mr. FERGUSON. Again, for a 20- or 30-year period, the American semiconductor industry and most especially the so-called merchant semiconductor manufacturers who depend upon selling semiconductors for their living—this is something of an exaggeration perhaps—but to a considerable extent they believed that they were the best in the world and the only in the world and that there was no point in even looking at what other people were doing because there was no possibility of it being competitive.

In part, this also reflects a broader national problem. The number of American students in Japan at any given time is less than 1,000. The number of Japanese students in the United States at any given time is in excess of 13,000. After a couple of decades, that shows up.

As a result, the American industry, which was very fragmented and dominated by entrepreneurs who did not have experience in intense global competition found itself really not understanding what was happening to it and only gradually has the industry concentrated itself, come to understand the nature of the threats facing it, and begun to realize that this really is a very, very big, very tough world.

Senator LEAHY. Mr. Reiling, in the United States, Digital really stands out as the success story. Its expansion, its development of new products, is remarkable. Let me ask you this, do you, within your company, debate the kinds of issues which Professor Ferguson has raised?

Mr. REILING. Yes, indeed.

Senator LEAHY. Do you share some of the concerns that Professor Ferguson has raised?

Mr. REILING. Yes, we do.

Senator LEAHY. I realize this is a very generalized question, but do you get a sense that there is this concern throughout the industry? Is there an awakening?

Mr. REILING. I believe there is.

Senator LEAHY. I hope so.

Mr. REILING. I think Sematech is the most visible example of the awakening.

Senator LEAHY. I will submit some further questions for the record. Of course, Mr. Ferguson's whole statement will be included in the record as though read.

[Prepared statement of Mr. Ferguson follows:]

THE COMPETITIVE DECLINE OF THE U.S. SEMICONDUCTOR INDUSTRY

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1. INTRODUCTION

The crisis of the American semiconductor industry is emblematic of an issue likely to assume greater prominence in the years ahead. In essence, the deterioration of its high technology industries confronts the United States with the prospect of a fundamentally weaker economic and geopolitical position, and a correspondingly greater dependence upon Japan. Between 1980 and 1986, for example, the U.S. high technology trade balance fell from +$27 billion to -$2 billion. But more importantly, the past decade has seen severe erosion of America's position in several high technology industries widely considered critical to future economic growth and military power. Continued decline in these sectors would affect not only the industries themselves, but also commercial and government users as well. The ultimate economic and political effects of this reversal could be quite large.

One major component of this process has been the decline of the U.S. semiconductor industry in the face of Japanese competition. Between 1978 and the present, Japan's share of the world semiconductor market (now about $30 billion) rose from 28 to 50 percent, the American industry's world market share declined from 55 to less than 40 percent, and the United States became a large net importer of advanced semiconductors. Japan now leads in several technologies and continues to progress more rapidly than the United States.

The deterioration of this quintessentially strategic industry poses challenges for both policymaking and economic analysis. Advanced microelectronics is a rapidly growing sector critical to the performance of the computer, telecommunications, aerospace, robotics, and defense industries. As such, it is not an arena in which U.S. abdication, and/or Japanese hegemony, can be taken lightly.

Here, I will consider the evidence of U.S. decline, its causes and consequences, and finally some Federal policy proposals.

2. THE NATURE AND EXTENT OF U.S. DECLINE IN SEMICONDUCTORS

The American semiconductor and related capital goods industries have been in relative decline (as measured by both technology and market share) for over a decade, though their absolute inferiority to Japanese producers is more recent. The process is most obvious in memory markets, where Japan has risen from 20% to 75% of world production since the late 1970s, but American decline has been widening rapidly and will soon be pervasive. It affects both "merchant" (i.e. open market) and "captive" (internal) producers; both memory and logic products; and R&D for future innovations as well as current technologies. Moreover, the decline of U.S. semiconductor capital equipment firms threatens both merchant and captive semiconductor producers who may not be able to obtain Japanese equipment on terms equal to Japanese producers.

Until the late 1970s, the American and Japanese industries evolved quasi-independently. Japan imported U.S. technology, restricted both import penetration and direct foreign investment by the U.S. semiconductor industry, produced for its domestic semiconductor market (particularly the export-oriented consumer

electronics industry), but largely refrained from direct semiconductor export drives. U.S. firms sold technology to Japan, generally acquiesced to Japanese protectionism, but also controlled the remainder of the world market.

The two national industries also diverged structurally. The Japanese industry became a stable, government protected oligopoly. Semiconductor production was dominated by large, diversified, integrated electronics firms such as NEC and Hitachi, for whom semiconductors accounted for 10 to 25 percent of total revenues. These firms used a substantial fraction of their semiconductor production in their own electronics products, such as computers. They also maintained close, enduring ties to their suppliers, their private and government customers, and sometimes each other. These companies are five to ten times larger than most of the U.S. semiconductor producers.

The American industry, by contrast, evolved into an unstable, fragmented, highly entrepreneurial arena. A few large U.S. firms, such as IBM, AT&T, DEC, and Hewlett Packard, developed substantial internal semiconductor production capabilities. But two-thirds of U.S. production, and nearly all open market selling, comes from the so-called merchant industry. Most U.S. merchant producers were established less than twenty years ago as small firms whose primary business was semiconductor manufacture. Market leadership, employee loyalties, and supplier - customer relationships were short-lived; semiconductor and equipment producers rose and fell rapidly.

But with the advent of Very Large Scale Integration (VLSI), microelectronics came of age. Capital intensive, automated mass production became essential, as did a wide technology base and large scale R&D. Semiconductors became ever more critical to a widening spectrum of products including consumer goods, computers, machine tools, weapons systems, and other products. These developments offered a potentially large comparative advantage to the Japanese semiconductor industry as a consequence of its technical diversification, large resources, and vertically integrated structure. This structural advantage also offered the possibility of large rewards in downstream industries based upon leadership in microelectronics. The Japanese industry, in part assisted by the national government, acted accordingly. In the late 1970s, Japanese firms suddenly entered world semiconductor markets, beginning with advanced commodity memories.

The ensuing decline of the American industry is noteworthy for its rapidity. Japanese firms now hold 75% of world markets for Dynamic Random Access Memories (DRAMs), 50% of the world market for Erasible Programmable Read Only Memories (EPROMs), 50% of world microprocessor markets, 70% of world microcontroller markets, and 40% of the world market for Application Specific Integrated Circuits (ASICs). These are among the most important, and most advanced, categories of semiconductor products.

Japan's share of the total world market has nearly doubled to 50% in the last eight years, while the U.S. industry's world market share shrank by 20%. The U.S. semiconductor trade balance stands at roughly -$1 billion, and six of the world's ten largest open-market semiconductor producers are Japanese. These Japanese companies are now gigantic industrial complexes with annual revenues of $15 billion to $30 billion each. Japanese industry now uses more semiconductors than the United States, despite the fact that its population and GNP are only half as large as ours.

Relative R&D performance has changed as dramatically. Between 1975 and 1982 the United States' share of world integrated circuit patent activity declined from 43% to 27%, while Japan's share rose from 18% to 48%. By the mid-1980s, over 40% of papers presented at the industry's largest conference (the IEEE Solid State Circuits Conference) came from Japan, as did over 20% of all semiconductor technical publications worldwide.

Less widely appreciated, but probably equally important, is the concomitant and structurally similar decline of the American semiconductor capital equipment, materials, and services industry. Once again, the Japanese industry is dominated by large diversified firms, either semiconductor producers themselves or major firms in relevant optical, chemical, mechanical, assembly, and/or construction technologies. These firms either produce directly or have close ties to firms which produce for them; some also sell to the market. Fujitsu owns 22% of Advantest (test equipment), NEC owns 50% of Ando (test equipment) and Hitachi owns Hitachi Electronic Engineering (various products). Hitachi and Matsushita manufacture their own automated assembly equipment, which is the best in the world; Toshiba and Hitachi produce electron beam equipment. Nikon and Canon produce advanced optical capital equipment; Shimizu, a large construction firm, builds clean room facilities; and so forth.

The American equipment industry, in turn, resembles its semiconductor producing counterpart in its fragmentation and entrepreneurialism. A few established equipment firms (e.g. Teradyne and Perkin-Elmer) coexist with innumerable startup companies - Trillium, Megatest, Ultratech, Master Images, and hundreds of others. And like the merchant semiconductor industry, the U.S. equipment industry is decaying rapidly.

Over the past decade, the world market share of the Japanese equipment industry has nearly tripled from 10% to 30%, primarily at the expense of U.S. firms. Moreover, Japanese producers have reached parity or even superiority in several critical technologies, including packaging, automated assembly, various ultrapure materials, some categories of production equipment, and maskmaking. Hoya and Shin-Etsu now hold over 90% of the world market for semiconductor-quality glass and quartz; Kyocera holds 70% of the world semiconductor package market; only one major U.S. producer of silicon remains, and Japanese producers are regarded as superior. IBM's new East Fishkill factory is being built by Shimizu, a Japanese construction firm, and Dai Nippon supplies nearly half of Intel's requirements for masks, which are the blueprints for semiconductor devices.

Japanese strength is also growing in R&D critical to future technology generations. Japanese efforts in X-ray lithography, which will probably dominate semiconductor production by the mid-1990s, dwarf those of the United States. NTT and its three largest electronics suppliers have committed billions of dollars for cooperative superconducting synchrotron-based R&D, while among U.S. firms only IBM has a substantial effort. Japan leads the United States in gallium arsenide research, and appears to have reached at least parity in laser systems, optoelectronics, and several other major technologies. Together these technologies are expected to dominate semiconductors and capital equipment by the year 2000.

3. THE SOURCES OF U.S. DECLINE

The principal sources of American failure are:

1) insufficient supplies of capital and highly skilled labor, which has reduced efficiency and raised the costs of both capital and professional labor to U.S. producers. Japan's savings rate has consistently been far higher, and its interest rates lower, than in the United States. In a capital intensive industry, lower capital costs are a substantial advantage. And Japan trains twice as many electrical engineers per capita as the United States. Not surprisingly, American salaries for engineers, managers, and computer scientists have until recently been at least twice as high as those in Japan. Moreover the Japanese government has supplied capital indirectly, by encouraging joint research and development and by providing procurement guarantees and direct assistance to the industry.

2) an excessively fragmented, unstable, and parochial industry, composed of small young firms without the managerial sophistication or resources necessary for success in a highly competitive, capital intensive, global industry. The fragmentation and instability of the industry has also worsened our disadvantages in capital and labor costs. High employee turnover has forced U.S. companies to raise salaries in order to retain key employees, and the instability of companies raised their capital costs because lenders or shareholders require higher returns to risky investments. Instability in the industry also prevented long term cooperation, and the gradual learning which is critical to continual manufacturing improvements.

And now, the industry is so capital intensive that small firms in new markets can only survive a few years before larger firms, usually Japanese, destroy them. Between 1980 and 1984 the capital - labor ratio in the U.S. semiconductor industry rose by 33%, and Japanese capital intensity grew even more. By the early 1980s an advanced semiconductor factory cost well over $100 million and the industry demanded extensive computer systems and software expertise. Technology trends indicate that by 1995, semiconductor factories will cost over $500 million each. Yet venture capital funded, tiny new firms have until recently continued to enter the U.S. industry, in part because foreign investors wanted an inexpensive way to acquire U.S. technology, and in part because tax subsidies favored the creation of new firms over the operations of existing firms. Typically they make profits for three to five years, and then fail as larger Japanese firms enter their markets.

3) a general lack of awareness and concern by the Federal government regarding the long term strength of American high technology industries. For the last thirty years, and still today, many Federal policies assume that U.S. technical and industrial superiority can be taken for granted. It cannot. This affects many policy areas, ranging from educational loans to export controls to Federal procurement to antitrust policy. Whether or not the divestiture of AT&T was a good thing, its competitiveness in international markets should have been considered an extremely important element in the decision.

Absent major policy changes, the prospect is for continued decline within the American industry, and for Japanese dominance of most semiconductor technologies and markets by the early 1990s.

4. THE CONSEQUENCES OF LOSING THE INDUSTRY

The economic and national security damage caused by permitting the continued decline of the American semiconductor industry, and equivalently the semiconductor capital equipment industry, would be quite large. The damage would come directly from the loss of the sectors, and indirectly from the effects of this loss upon "downstream" industries - those dependent upon semiconductor technology for their own technology and products.

Microelectronics and the sectors it supports contribute disproportionately to growth in productivity, GNP, competitiveness, and military capabilities. The semiconductor content of computers, industrial electronics, telecommunications equipment, and military electronics typically ranges from 3 to 10 percent, and it is increasing rapidly. Dataquest, a market research firm, estimates semiconductor content as follows:

Category	1985	1990 (estimated)
Data Processing Equipment	4.5%	6.6%
Communications Equipment	5.0	7.0
Industrial Electronics	4.4	5.5
Military Electronics	3.0	3.4
Automotive Electronics	9.3	10.1

(auto electronic content, not entire automobiles)
Source: Dataquest Semiconductor Industry Service, 1986.

There is universal agreement within these industries that semiconductor technology is even more important than these statistics might suggest. Access to the best available semiconductor technology, for example, is a major competitive asset in the computer and communications industries.

Furthermore, the decline of these industries would reduce the nation's GNP, trade balances, and living standards. In 1984, for example, U.S. private sector wages averaged $350 per week. Manufacturing sector wages averaged $434 per week. But average weekly wages in the semiconductor industry (SIC 3674) were far higher - $516. In the computer industry (SIC 3573) wages averaged $552, and in the entire office machines sector (SICs 3570 through 3579) they averaged $546. The decline of these industries, which employ over one million Americans, would therefore reduce our welfare by changing the mix of U.S. economic activity towards lower wage industries. Some of these industries, such as the computer and aerospace industries, are among the few which are still net exporters. Damage to these sectors would hurt our trade balance as well.

And these industries are also growing more rapidly than the economy as a whole. By the year 2000, the computer industry will be nearly a $1 trillion industry worldwide (versus $200 billion currently). The semiconductor industry alone will be $200 billion. If we fail to compete in these industries, we will suffer accordingly in our trade balances, economic welfare, tax receipts, and defense posture. While Japan is a military ally, we would be a stronger nation if we did not depend upon Japan for all of the high technology needed for our economy and national defense.

5. PROPOSED FEDERAL ACTIONS ON BEHALF OF THE INDUSTRY

As is probably clear, I believe that we cannot afford to let the Japanese industry dominate world semiconductor technology and markets. The relevant Japanese firms are highly desirous of controlling the larger industries, such as computers, which depend upon semiconductors. As a result, these firms may not make their best semiconductor technology available to U.S. firms. The same is true of their semiconductor capital equipment.

Consequently, I think it is imperative that the Federal government take steps to maintain a competitive semiconductor industry in the United States. While in the present budgetary environment spending billions of dollars is not terribly popular, it will prove far less expensive than letting this industry die. If the American semiconductor industry and others dependent upon it cannot stay competitive, we will pay an enormous price economically, politically, and militarily. The current crisis in the semiconductor industry, which is very small by comparison with what we could face in the future, has already cost us 60,000 layoffs and a billion dollars in the trade balance. Let me briefly indicate, therefore, what I believe the Federal government could do to improve the industry's position.

I will begin negatively, by mentioning two alternatives which I think would be of no value whatever. They are protectionism and the establishment of specifically military activities.

Protectionism alone is of absolutely no benefit to a high technology industry. The cost / performance ratio of semiconductor products changes 40 percent per year. Maintaining a profitable but obsolete industry would leave us a factor of ten behind our competition, both military and commercial, within a decade. Only measures which maintain a competitive rate of technological progress within the industry are useful.

For somewhat similar reasons, specifically military efforts are equally futile. Military consumption is only 10 percent of the semiconductor market, and most military products are developed after, not before, their commercial equivalents. If the whole industry disappears, no military program can possibly replace it. Conversely, if our commercial industry is healthy, the military will get the benefits of commercial technology. This is not to say the the Defense Department has no proper role in helping the industry. On the contrary, I deeply believe that it is in the Defense Department's and the nation's interest to fund generic R&D and technological development in order to maintain a healthy industry able to meet both commercial and defense requirements.

In other words, Federal support could be of significant benefit, if it took the appropriate forms. I believe that the government should support the industry in 4 broad areas:

1. First, we need large increases in financial support for technical education, semiconductor and related R&D, technical training, and policy analysis related to high technology industries. We should at least double our expenditures and human resources in these areas. There is no reason why we should have proportionately only half as many engineers and major research laboratories as Japan.

2. Second, significant measures should be taken to require Japan and other foreign economic competitors to abide by U.S. intellectual property laws, and to open their markets to U.S. products. While there are positive trends in these areas, much remains to be done. U.S. enforcement procedures, particularly where they rely upon the courts, are often cumbersome.

3. Third, the Federal government should provide direct industrial assistance, both immediate and long term, in the form of contracts for the establishment and operation of R&D facilities, procurement commitments, low interest long term loans, and loan guarantees.

I should emphasize that the industry needs both immediate and long term support, and Federal action should be directed not only to the immediate crisis, but also towards providing incentives for private industry to make long term, large scale commitments to semiconductor technology.

These efforts should not discriminate against large firms, nor against cooperative efforts. By providing 1 to 2 billion dollars, beginning immediately, to a small number of cooperative industrial efforts - perhaps 2 or 3 of them - the government could help the industry develop the next generation of technology and capital equipment, and reverse its decline. I believe that the recommendations of the Defense Science Board are a generally positive step, as is Sematech, the industry's proposed joint venture. They deserve Federal support. But two warnings are in order.

First, Federal funds should not be dispersed across hundreds of small companies throughout the industry. The semiconductor industry is now very expensive, very competitive, and very important. We need to build enduring, strong, competitive companies for the next twenty years. Federal funds should require large, long-term, matching commitments from private firms and joint ventures. If necessary, antitrust dispensations should be provided, and there should NOT be any attempt by the Federal government to manage the effort.

Second, while we need major assistance now, Sematech is just a small interim step. We will need enormously larger commitments over the next decade, and they should be oriented towards the future as well as the present. This means stable, increasing funding for R&D, shared development facilities, long term Federal

procurement of commercial products, scholarships and loans for engineering education, more training in foreign languages such as Japanese, and long term loan guarantees for industrial R&D and semiconductor capital spending.

4. And finally, we need to incorporate our long term competitiveness and technological strength into every calculation we make about Federal policy. In a hundred areas - student loans, tax policy, NSF budgets, export controls, antitrust policy, Defense procurement policy and regulations, trade policy, intellectual property rights - Federal policy matters. This is not a specific proposal about a specific industry, but rather a reflection of the fact that we can no longer take our technological and economic strength for granted, as we have in the past. We must begin planning now to ensure that we are strong, economically, and politically, in the future.

Thank you.

Senator LEAHY. Actually, I am going to keep the record open for questions until March 15 so that we can encompass questions that might come up after our Tuesday hearing.

Senator DeConcini, of course, wanted to be here but the Intelligence Committee has meetings this morning in relation to the Tower Report. He also has an Appropriations Committee meeting and a Veterans Committee meeting. What Senator DeConcini and I have tried to do is to make sure to whatever extent possible that as his committee meets that either I or a representative will be there and vice versa in these issues.

I do not pretend to have all the answers. I think we share the concerns you have. I think this testimony has been very valuable. I hope, you understand how important it is and I hope you understand also that this committee will continue to gather information on this subject. I thank you for being here.

[Whereupon, at 11:35 a.m., the hearing was adjourned.]

ISSUES CONFRONTING THE SEMICONDUCTOR INDUSTRY

TUESDAY, MARCH 3, 1987

U.S. SENATE,
SUBCOMMITTEE ON TECHNOLOGY AND THE LAW,
COMMITTEE ON THE JUDICIARY,
Washington, DC.

The subcommittee met at 3:08 p.m., in room SD 226, Dirksen Senate Office Building, Hon. Patrick J. Leahy (chairman of the subcommittee) presiding.

Also present: Senators Leahy and Humphrey.

Staff present: Ann Harkins, Chief Counsel; Matt Gerson, Counsel, and George Smith, Counsel.

OPENING STATEMENT OF SENATOR PATRICK J. LEAHY, A U.S. SENATOR FROM THE STATE OF VERMONT

Senator LEAHY. The subcommittee will come to order.

This is the second part of our hearing on issues confronting the Semiconductor Industry. We started late this afternoon because I was up in Vermont for Town Meeting Day. Whatever we do here in Washington pales in significance to that. All of Vermont comes to a screeching halt for Town Meeting Day.

Last week, this subcommittee heard some very disturbing testimony. As we all know, semiconductor chips are vital to our Nation's defense systems. Yet, a representative from the Department of Defense told the subcommittee that the United States is soon going to be dependent on foreign companies for those chips, an integral part of virtually every aspect of our defense systems.

Companies that make consumer goods are facing a similar fate. According to a computer policy expert, in five years, personal computers, cars, microwaves and other products that Americans use daily will all be running on foreign chips. Basically, his testimony reflected his belief that without some dramatic changes not only will the United States be overtaken and supplanted in the area of microchips by foreign competitors in about five years, but there is probably no conceivable way to ever regain the prominence in the semiconductor industry that we have had during the past decade.

Those assertions are troubling, to say the least. Only a decade ago, we led the world in semiconductor technology. Many of us expected the semiconductor industry to provide the new American industrial base. Technologies and the products they generate were supposed to be a contribution to the international marketplace.

Now, it appears to me that whether or not America brings the 21st Century to the rest of the world is the key question for our witnesses today. First, we are going to hear from Norman Augustine, who is Chairman of the Defense Science Board Task Force on Semiconductor Dependence, and President of Martin Marietta Corporation, a corporation which obviously relies on semi-conductors to provide our military forces with state-of-the-art weaponry.

And we are going to hear from Dr. Robert Noyce, the man who invented these technological marvels, who is now Vice Chairman of Intel Corporation, a major producer of semiconductor chips.

He is going to be joined by John Cornell, the Senior Vice President of Harris Corporation, another major producer of semiconductor chips.

So, Messrs. Augustine, Noyce and Cornell, if you could come on up and join us at the table.

Now, your written statements, of course, will be made part of the record as though read and I would ask if you could just summarize in five minutes those points that you most want us to focus on.

One of the things in your summary that you may want to address is whether it is true that in five years we will be reliant on foreign manufacturers for semiconductor chips. Is it true that the United States, without major changes, is going to lose and lose very quickly its technological advantage and will for the rest of this century and into the next century be playing catch-up to other nations? Is it true that the United States is about to become second rate, in effect, as far as the production of semiconductor chips is concerned: Is it true that the Japanese and others are going to eclipse our place in the world semiconductor market?

Is it true that we are going to end up being a nation able to serve hamburgers but not handle computers? So we will start with you, Mr. Augustine.

STATEMENT OF A PANEL CONSISTING OF NORMAN R. AUGUSTINE, PRESIDENT AND CHIEF OPERATING OFFICER, MARTIN MARIETTA CORP., AND CHAIRMAN, DEFENSE SCIENCE BOARD, TASK FORCE ON DEFENSE SEMICONDUCTOR DEPENDENCY; ROBERT NOYCE, VICE CHAIRMAN OF THE BOARD, INTEL CORP., ON BEHALF OF THE SEMICONDUCTOR INDUSTRY ASSOCIATION; AND JONATHAN E. CORNELL, SENIOR VICE PRESIDENT, HARRIS CORP., AND SECTOR EXECUTIVE, SEMICONDUCTOR SECTOR, ON BEHALF OF THE SEMICONDUCTOR INDUSTRY ASSOCIATION

Mr. AUGUSTINE. Thank you, Mr. Chairman, both you and the members of the committee for the opportunity to talk on this subject.

With the committee's permission, I will submit a written statement for the record and I will speak extemporaneously for a moment.

I would begin by pointing out that, in my professional career, I cannot remember having dealt with a subject that I felt was of more importance to defense or to the country in terms of the economy as a whole. I probably also should point out that my company is not a member of the semiconductor industry and this testimony

is primarily in my capacity as Chairman of the Defense Science Board task force that studied this issue on behalf of the DOD.

The Defense Department itself became concerned about the problem of semiconductor dependency, as it is called, somewhat over a year ago. At that time a task force was set up at Secretary Weinberger's request. The membership of it included eleven people who were members of the National Academy of Engineering, seven former presidential appointees and the people who are considered to have invented the chip in the first place.

The committee worked for about a year. We have now completed our efforts. A report has been issued which is available to the committee.

The first question that comes to mind is why is it important that we address this subject of semiconductor industry competitiveness. The committee addressed it from the standpoint of national defense. As is well known, our forces tend to be substantially outnumbered in military manpower and material by Soviet forces. We rely on technological leadership for the ability to deter and to win.

Electronics, and semiconductors in particular, are generally at the root of the technological advantage that our systems hold. If we are to depend on smaller forces with high technology to win, semiconductors truly can be said to underpin the capability of our defense forces to a very considerable degree.

In terms of the impact on our economy, the answer is just as clear. I would describe the semiconductor chip as the critical element that ties together the computer industry, the telecommunications industry, and much of the consumer electronics industry. Even though the semiconductor industry in its own right is not really a very large industry, it is the basis that holds up what today is about a $400 billion information industry, moving toward being a trillion-dollar industry in the year 2000.

So it is extremely important in our judgment that the U.S. have a viable domestic semiconductor industry. What then is the health of that industry today?

Our conclusion is that there is considerable reason for concern. The state of the art goes very rapidly in this industry. A new generation comes up about every 2½ years, on the average, which means that if you are 2 or 3 years behind you are a whole generation out of date.

Market share, in terms of manufacturing capability, has moved to the Pacific rim. If you take the vital, dynamic random access memory chip, in effect the bellwether of the industry, we have gone from near 100 percent market share in 1970 to under 10 percent today, and the U.S. share is still declining.

Of more concern to the Defense Science Board Task Force was a consequence that we hadn't fully appreciated when we began, namely, that we are losing ground in terms of R&D leadership. Our technological leadership is clearly being lost and being lost at an increasing pace.

Part of the reason is that the funding which underlies the advancement of technology comes largely from the production of dynamic random access chips and other chips of that type.

One of the implications for the Defense Department—not speaking on behalf of the Defense Department, because the DOD still

has this issue under consideration, but speaking on behalf of the Defense Science Board—our conclusion would be that we soon will face a choice in our defense systems where we will either be able to have the second best chips, the second most advanced, or we will be able to have foreign chips. It is our belief that neither of those outcomes is acceptable for a nation that has its defense policy to a considerable degree based on technological superiority. All of that, of course, says nothing about the economic implications for the economy as a whole.

Senator LEAHY. And those are the only options, second best or foreign supplied?

Mr. AUGUSTINE. We believe that if we do not change the course that we are now on, that those will be the only options and we believe that those will be the only options in the not too distant future. And while I would not want to predict exact years, we are talking of a period of a few years.

The Defense Science Board offers several recommendations to develop other options. By far the most important is to establish a Semiconductor Manufacturing Technology Institute that would enable the U.S. to be more competitive. The institute would develop generic technology in the field of manufacturing to be shared among U.S. semiconductor firms which could then compete with each other and with foreign competitors at the product level. We felt that such an institute essentially should be funded and run by industry, but should be supported by the Defense Department with contract support because, in our judgment, the Defense Department needs a strong semiconductor industry to carry out its mission.

There may be some who ask why DOD or the government should provide support for the semiconductor industry and help a few companies that are having financial difficulties. In my opinion, that would be much like asking at the outset of World War II why we should buy ships and airplanes because it might help the shipbuilding and the air-craft industries.

In conclusion, the Defense Science Board task force views the current situation in the semiconductor industry with substantial concern. The trend is far from encouraging but it is probably not too late to do something about it. We need to act rather quickly, and we need to act in concert because, as the task force concluded, it does not appear that industry alone or government alone or academia alone will be able to compete in the type of a marketplace that exists in the semiconductor field today.

Thank you very much, Mr. Chairman and members of the committee.

Senator LEAHY. Thank you. How would the semiconductor industry consortium you spoke of compete in the international marketplace if it is developing chips solely to satisfy defense needs? These chips may be radiation hardened, or developed in other ways that would not allow them to be used as such in a commercial marketplace. Because of a particular defense need, they may be more expensive than commercial application would demand. If that is so, are they competitive?

Mr. AUGUSTINE. Mr. Chairman, you touch on what is absolutely the critical point of this issue. Fifteen years ago, one could say, de-

fense dominated the semiconductor marketplace. Today, defense needs are a rather minor segment of the marketplace in terms of types of chips or total production.

If defense, then, is to have the kinds of chips it needs, it is going to have to acquire them from a robust commercial chip industry. A specialized chip making capability for defense will be so small that it will not be able to advance the state of the art in the huge volume that is required by commercial companies.

So I think the fundamental point is that DOD is dependent upon a commercial semiconductor industry. This institute would address the commercial problems, by and large, of producing chips less expensively, chips with more capability, and anything that was unique to DOD would be a secondary or a subsidiary purpose of this institute. The institute would develop chips that are competitive on the world market. But, other than limited quantities, the institute would not sell on the world market. The institute would make these advanced chips available to member companies and, more importantly, make the technology available to member companies, which would compete with commercial products in the commercial world.

Senator LEAHY. I want to come back to that subject a bit later.

[Prepared statement follows:]

STATEMENT OF

NORMAN R. AUGUSTINE

CHAIRMAN, DEFENSE SCIENCE BOARD TASK FORCE

ON DEFENSE SEMICONDUCTOR DEPENDENCY

Mr. Chairman. Members of this distinguished committee. I very much appreciate the opportunity to come before you to discuss the serious challenge facing the U.S. semiconductor industry, both as a producer of an essential component for modern defense systems and as a viable participant in our overall economy.

These two aspects of the semiconductor industry are of course closely related. Inasmuch as defense is only a comparatively small segment of the semiconductor marketplace in this burgeoning age of consumer electronics, information systems, and high-speed telecommunications, only a commercially successful industry can be a dependable, modern, long-term supplier for defense systems. Because of these considerations, the Department of Defense initiated a study by the Defense Science Board to examine the impact of trends in the semiconductor industry on national defense. The Department is currently examining this problem in the larger context of industrial readiness as it is affected by other industries facing serious problems of competitiveness.

Only a robust semiconductor industry can maintain the level of advanced research and aggressive product development essential in a field characterized by incredibly rapid technological progress and change. At the present time and for the foreseeable future, the semiconductor industry is an industry where the only place to be is on the leading edge if one wishes to remain in business.

This hearing is most timely because, in my view, the time is now for our concerted action as a nation. The challenge is clear and it will not go away. But our semiconductor industry, with its vital economic role and essential national security role, will go away if we do not act promptly.

The Defense Science Board Task Force, of which I had the honor to be chairman, conducted an intensive year-long study of "Defense Semiconductor Dependency."

I will not take your time now to list the membership of this task force or its advisory group except to say that the members were well qualified representatives of government, industry, and the technical community, including the man who invented the semiconductor chip, eleven members of the National Academy of Engineering, and seven former Presidential appointees. I should emphasize that my testimony today is a product of the Defense Science Board, which is strictly an advisory group. Our recommendations are being considered by the Department and will become policy only if accepted after appropriate consideration.

I will not linger over the detailed findings of the DSB task force, except to say that I hope and trust that they prove a valuable contribution to the deliberations of this committee. I do want to use this opening statement, however, to emphasize a few points both in my task force capacity and as a member of a corporation that procures and utilizes semiconductors from others in the discharge of major government contracts on behalf of defense and space programs.

I should point out that my company is not, in the sense of this discussion, itself a part of the semiconductor industry. We design a certain number of chips, manufacture a smaller number for specialized uses in defense systems, and participate in research to meet such special needs. But, by and large, we are customers for chips on behalf of our government customers.

Obviously, any inquiry about the semiconductor industry must begin with an effort to ascertain its true state of health. How serious is the problem? The answer, we found, is that the industry is unquestionably in a state of considerable duress. A few comparative figures make this clear:

o One critical indicator is the so-called "bellwether chip," the dynamic random access memory or DRAM chip. The market share of U.S. manufacturers in this area has gone from 100% in 1970 to well under 10% today and continues to decline.

o The U.S. share of the worldwide merchant semiconductor market, or open market, also has been declining steadily--from nearly 60% in 1975, to below 50% in 1985, to below 45% in 1986. Japan's share over the same period has increased from 20% in 1975, to 40% in 1985, to slightly more than the U.S. 45%

share in 1986. The merchant market in general, and the DRAM market in particular, are of primary relevance to defense needs, because the former generally comprises the defense suppliers and the latter is the highest volume segment of this manufacturing-intensive industry.

o The most advanced generation of memory chip is today being produced by eight Japanese firms but only one U.S. merchant firm and two U.S. "captive" firms.

That, briefly, is where the industry stands in terms of manufacturing capability. The trend, without a concerted rescue effort, is clear and it has several other dimensions. Perhaps most critical of all is the fact that R&D in the U.S. semiconductor industry also is lagging. Further, the U.S. once dominated the vital semiconductor manufacturing equipment industry, with a market share of more than 90% in the early 1970s. The U.S. share now is less than 50% by most measures and declining rapidly as another significant capability moves offshore.

Perhaps the best known U.S. supercomputer, the Cray, has 100% of its memory chips and 10% of its logic chips made in Japan. As the Japanese move into the supercomputer field themselves, there is every reason from a business standpoint to expect that they will begin to deny the latest chips to competitors in this country as a normal business practice.

There was a time, in the 1960s, when a large percentage of the semiconductors produced went into defense systems. Defense was the prime market. Today electronic chips provide a major example of the migration of new technology from defense and space to the commercial economy. The defense market now is less than 10% of the overall market.

On the other hand, semiconductors or integrated circuits play an increasingly important role in defense of the free world and, accordingly, in the products of today's leading defense contractors. That is primarily because U.S. military forces depend heavily on technological superiority to deter war and to win in combat. Better equipment, we trust, will give us the edge in a world where we are significantly outnumbered in military manpower and materiel by our major potential adversary.

Military technological advantage today depends, in large measure, on electronics. And ever more sophisticated, faster, larger capacity semiconductors are the key to leadership in electronics. Therefore, to go one step further, the health and strength of our semiconductor industry are clearly central to electronic leadership and the technological lead it has provided our armed forces in the past.

The dilemma facing the Department of Defense, and facing the nation, is obvious. Sophisticated semiconductors, the products of a swiftly declining U.S. industry, are essential in the whole range of defense systems from early-warning satellites to battle tanks, from frigates to fighter bombers, from smart projectiles to strategic weapons. We cannot build modern systems without semiconductors, and without incorporating continuing technological advances in each new generation of equipment.

If the present decline in market share and resultant industrial vitality continues, there is no question that defense manufacturers will have to turn to overseas suppliers and accept overseas dependence for these essential components. In our DOD study, we concluded that this option was unacceptable in terms of our long-term national security. I assume that most Americans would agree.

The economic corollary of U.S. retreat from this technology-intensive area seems equally untenable at this stage of world history.

We are living at a time that has been described as another industrial revolution based on various applications of electronics through computers, communications, artificial intelligence, and so on. The semiconductor underpins the entire, broad information systems industry, which is a $400-billion industry worldwide today, is expected to be a trillion-dollar industry by the year 2000, and potentially will be the most important segment of the U.S. economy in the 21st century. While the Task Force's mandate, and primary concern, were the defense implications of this subject, the group also reached the parallel conclusion that the purely economic aspects were of immense import in themselves.

We reached several recommendations in response to this broad challenge. In

effect, they bring together the efforts of government, industry, and the academic community on an enduring basis in a joint action plan aimed at restoring and enhancing our competitive role in the semiconductor marketplace.

The most fundamental recommendation is to establish a Semiconductor Manufacturing Technology Institute as a U.S. industry consortium, with capitalization by its member companies and support by DOD through contracts over the next five years for development of critical production processes, equipment, materials, and devices. In essence, this would be a generic manufacturing technology organization with emphasis on transferring the results to the production lines of the member organizations.

It must be emphasized that government support of this initiative is recommended solely from the standpoint of national defense requirements. That is to say, the hypothetical question "Why should the government spend money to bail out the semiconductor industry?" seems as irrelevant as asking, at the outset of World War II, why the government should procure ships and planes since doing so would surely benefit the shipbuilding and aircraft firms.

I submit that this and our other recommendations--including establishment of semiconductor science and engineering centers at eight universities--provide a simple, straightforward, common sense approach to a major and growing problem. I believe that, if undertaken now, before the situation deteriorates any further, they offer a reasonably good chance to restore both our semiconductor industry and our technological leadership in a field with profound ramifications in both the national defense and economic spheres. Time, however, is crucial. We must get on with the job.

With that, I will conclude my prepared statement. I would be happy to make available, on behalf of the Department of Defense, copies of the report of the Defense Science Board on semiconductor dependency. I have appreciated this opportunity to address one of the most important subjects encountered in my professional career, and I look forward to continuing this discussion in response to any questions you may have.

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Senator LEAHY. Mr. Noyce, again your statement will be part of the record, but please feel free to summarize any way you would like. You understand the thrust of my concerns on this committee: Are we seeing the sunset of our semiconductor industry, is it going to die in 5 years, are we going to have to rely on foreign suppliers to such an extent, that we become a second rate nation as far as the semiconductor industry is concerned, have we become second rate already?

STATEMENT OF ROBERT NOYCE

Mr. NOYCE. Thank you very much, Mr. Chairman. First of all, I am Bob Noyce, and I am Vice Chairman of Intel. Again, I appreciate the chance to appear here before the committee.

We certainly support the conclusions of the Defense Science Board in this study. I have been in the semiconductor industry now for some 34 years, almost from the beginning. That makes me an old, old man in this rather young industry.

But we have been faced with competitive challenges many times over the past, and until the mid-seventies we were winning every battle that came along. The change that really happened in the mid-seventies was that Japan made it a national objective to penetrate the semiconductor industry, and that was done through a coordinated set of policies which, first of all, closed the Japanese market to the Americans. It was illegal for us to invest in semiconductor production in Japan until the early seventies, for instance, and in spite of the many market openings that Japan has made, the fraction of Japanese sales that have been enjoyed by U.S. semiconductor manufacturers, has been only 10 percent of that market.

Wherever we have competed with the Japanese in other parts of the world, we have a larger market share than do the Japanese. In other words, right now the Japanese have an effectively closed market, in spite of the various measures that they have been encouraged to take by our government.

Senator LEAHY. Japan has a closed market?

Mr. NOYCE. Yes.

Senator LEAHY.They have shut us out?

Mr. NOYCE. That is exactly correct.

Senator LEAHY. Have they done that illegally, in your judgment?

Mr. NOYCE. No, I do not know that there is anything illegal about it. They are a sovereign nation, just as we are, and they can choose what they want, but we need to have a reasonable response to that.

The other thing that——

Senator LEAHY. But notwithstanding the very nice things they say at the economic summit meetings and the things that we hear from their Prime Minister when he visits here, and no matter how many number of times their parliamentarians come and speak with members of the Senate and claim that it is an open and free market, what you are saying is it is not so, Japan is freezing us out.

Mr. NOYCE. I think we have to look at the situation de facto, instead of de jure, on this one.

Senator LEAHY. We have to look at it as de facto. De politico is another way of saying that.

Mr. NOYCE. OK.

Senator LEAHY. It doesn't look like they were telling us the whole truth. Please, go ahead.

Mr. NOYCE. As a result of encouraging their own industry, they built over-capacity and that has led to significant dumping on the world market.

Finally, the industry has filed both a 301 complaint and anti-dumping complaints with the government, and indeed the government has filed its own dumping complaint, self-initiated by the government.

Senator LEAHY. Three of those 301 cases have just recently been settled, I understand.

Mr. NOYCE. They were settled in an agreement that was signed at the end of July, finally formally adopted on September 2nd last fall, which provided for essentially three points: One, that they would cease dumping in the U.S.; two, that they would not dump in third-country markets; and, three, that they would increase the access of American semiconductor manufacturers to the Japanese market.

Now, just as a progress report, I would say that on the first point essentially they have lived up to the agreement. There is evidence that they are no longer dumping on the American market, in essence they have dropped out of it, but they are still dumping drastically as far as we can see on the third-country markets, and the best evidence that we have so far is that the U.S. market share has dropped from the time of the signing of that agreement, rather than increasing. It was probably about 12 percent last September, and most recent data would indicate that it is of the order of 8 percent.

Now, there has been continuing negotiations on this and the negotiators have encouraged the Japanese to live up to the agreement. I guess my feeling is that the Japanese in this case feel that having some kind of agreement the problem has gone away, that living up to it is another question, and that in order to encourage them to live up to that agreement we are going to have to do something more.

Our government negotiators have set a deadline of March 31st for some significant progress for living up to the agreement, with the suggestion that appropriate measures will be taken if that does not come to pass.

I think that it is extremely important, now that we have signed an agreement on this, which is clearly being violated by the Japanese, that either they be forced to live up to that agreement or that punitive measures be taken. If that is not done, we can forget about all the rest of our trade policy as well.

Now, the semiconductor industry, even though Mr. Ferguson might like to call it dead already, is alive and well and still very, very competitive. We have done a number of things of our own doing in order to increase the competitiveness of the nation in this industry, but I think that there are a number of other things to be done which are outlined in my written testimony.

We would encourage the Congress to look at these points and look at those things which government can do in order to help the industry survive and thrive. Among those—and the subject that Mr. Cornell is going to talk about—is indeed the Manufacturing Technology Institute that Mr. Augustine has referred to and the Defense Science Board report has referred to.

The industry, in parallel with the work that the Defense Science Board has been conducting, has been trying to form its own ideas as to what should be done, and Mr. Cornell will outline that. But other than that, the things that we need to have done I think are those that are reasonably obvious, to encourage R&D, to encourage more training of qualified people, to help the capital availability, because this is a deep pocket game as it is being played now, to protect the intellectual property that is rightfully the property of the American companies that is being widely copied, and to make it more possible for the American companies to compete on the world market by looking at the issue of export controls, R&D subsidies and the like. Those are covered in the written testimony and are there for the record.

Senator LEAHY. In his testimony last week, Mr. Ferguson made two things very clear: One, that he can get into some very violent disagreements with some in the industry on what he freely admits is a somewhat apocalyptic view of the industry. And two, that we are going to be in very, very deep trouble unless steps are taken to strengthen the semiconductor industry in this country. You have listed a number of things that can be done. Let me just make sure I understand.

Do you think that this projection of the United States dropping into second or possibly third place is avoidable? Do you agree with the prediction made by some that our semiconductor industry is going to fall behind either the Japanese or the Europeans and that we have to rely on non-U.S. based supplies for our semiconductor industry? Do you think that is an avoidable situation? And do you think that there is enough realization of the steps necessary to be taken to avoid it, that it will be avoided?

Mr. NOYCE. Well, I certainly think that it is an avoidable situation. We recently had Professor Ferguson come out and talk to our executive staff. As a matter of fact, we would like to get all of the viewpoints that we can in our own decision-making and we listened carefully to him for about three hours. I think that we understand where his point of view and his projection of the current trends come from. But let us not get too discouraged. A number of things have changed.

During the first half of the eighties, the extremely high dollar did almost irreparable damage to the industry. The fact that the dollar has come down now has alleviated some of those pressures, but still we have not taken care of some of the basic problems like the savings deficit that still does exist in this country.

The industry itself has certainly spent a great deal of more time looking at its manufacturing capability as compared to its innovative capability. The innovative capability of the U.S. industry is still far superior to that of Japan. If you look at the major advances in the applications of semiconductors, they have originated in America, not in Japan. Japan has been the one that has been

doing the catch-up game until this point, and they are coming to parity with the U.S. now.

If we can create an environment in the U.S. conducive to doing R&D, doing high-capital intensity manufacturing, we can maintain this industry here. Failing to take those actions, however, I think Professor Ferguson's predictions could come true.

Senator LEAHY. Well, the New York Times today had an article that I read coming down from Vermont referring to the hearings we held last week. At one point referring to comments made by Paul Lowe of IBM. The article says that increasingly Japan has taken over the manufacturing equipment market and IBM officials fear they may not be able to buy state-of-the-art equipment, including the optical steppers used to burn the pattern of circuitry onto silicon to make the next generation of chips, and quotes Mr. Lowe as saying it is more than just steppers, "we can't get gases today with the kind of purity that you need to make high-density chips." Is this the kind of manufacturing concern that you have, too?

Mr. NOYCE. Certainly the equipment industry, yes. I think that the statement that Paul made about the gases was not only referring to U.S. supplies but even Japanese supplies, that there is work to be done in order to advance the technology in the purity of gases. And it is true that the equipment supply industry was largely American ten years ago and it is now about 50 percent sourced in Japan. The optical steppers are one of the obvious ones. On the other hand, it may be a natural business for Japan, considering their very strong position in optics. We do not have many people that make good 35mm cameras in this country either, and it is the same people incidentally that are making the steppers.

Senator LEAHY. How well I know. I have spent a lot of time in photography and I know what that is like. I should not digress in this and I am indulging the luxury of being back in the majority and being a chairman for a change, but I recall days in China before normalization and I was doing a photographic essay for one of our major news magazines and so I tried to find a way to get crowds of people and I found a very easy way, to take a relatively inexpensive Polaroid camera—back then nobody had ever seen one. This is 1978 or so. Take a couple Polaroid shots and a crowd of people would come around and you could photograph all you want.

I took one and they were crowding around talking with my wife and so I stood back with the Nikon, with about a 200mm lens and started shooting away, and one of the fellows came over who spoke English and asked to see the photograph. And I am trying to explain the difference between Polaroid and 35mm and he looks at the camera and he goes, "Nikon, Nikon." He said, "Ah, Japanese." "Oh," he said, "I understand that their technology is not as good as American." I said that is true, and I did my best for international relations. There was no need to try to explain any further.

Mr. NOYCE. That may even be indicative of the problem that the innovation is here, but the commercialization has been there.

Senator LEAHY. I understand. Incidentally, in that same New York Times article it says: "Officials of Intel and several other chip makers say that without high-volume manufacturing, the consortium may be worthless." Is that a correct reflection of Intel's position?

Mr. NOYCE. That is a correct quote. Let me make another couple comments here, too. The support of the consortium is without question. The question is, rather, what is going to maximize the benefit per input dollar. There has been a great deal of discussion over the last nine months about that issue and there is honest disagreement among the various members of that planning group.

Intel has taken the position, because we believe it, that to be most effective this consortium should be in high-volume manufacturing. There is a counterposition which says that it should be a manufacturing technology development center which is where the technology is then passed on to other manufacturers in volume production.

Our observation would be that the volume production is absolutely essential, and I think that there is overall agreement on that. It is only a question of whether it be done within the consortium facilities or within the consortium members' own factories.

Senator LEAHY. Is it your feeling that without high volume we do not get a good picture.

Mr. NOYCE. You do not find all the problems.

Senator LEAHY. Thank you.

[Prepared statement follows:]

Testimony of
DR. ROBERT NOYCE

on behalf of the
SEMICONDUCTOR INDUSTRY ASSOCIATION

Thank you, Mr. Chairman, for this opportunity to appear before your committee today. In my testimony I will review the current competitive challenge to the U.S. semiconductor industry and provide information on the Semiconductor Industry Association's public policy agenda to meet that challenge.

I. INTRODUCTION

America has been challenged to increase its competitiveness in order to reverse the trend toward ever rising trade deficits while maintaining a high standard of living. In the debate on industrial competitiveness, the U.S. semiconductor industry emerges as a focal point of discussion because it is the critical leverage point to renewed American competitiveness in many other industries.

The U.S. semiconductor industry is internationally competitive, but faces a severe challenge from overseas competitors, particularly from Japan. This paper 1) describes the role of semiconductors as a leverage point in overall American competitiveness; 2) outlines the challenge facing the U.S. chip industry; and 3) presents an agenda for U.S. semiconductor leadership.

This year many groups within the United States have recognized the need for immediate action to restore U.S. manufacturing industries to a position of international competitiveness. President Reagan has set a national goal of assuring American competitive preeminence into the 21st century; the 100th Congress has established a Competitiveness Caucus; and several competitiveness institutes have been formed. All seek to improve America's competitive position in a global marketplace.

In discussions of American competitiveness, the case of semiconductors is often raised. This is because the U.S. semiconductor industry traditionally has been a model of innovation and productivity, because the chip industry has a leveraged, or multiplied effect on many other industries such as computers and telecommunications, and because the chip industry today faces severe challenges from foreign competition.

Americans invented the transistor in 1947 and the integrated circuit in 1959. Since that time, American companies have made virtually all of the technological breakthroughs in the semiconductor industry.

Figure 1

REVOLUTIONARY PRODUCTS

1947	Transistor	(Bell Labs)
1959	Integrated Circuit	(Fairchild/TI)
1962	MOSFET	(RCA)
1970	1K DRAM	(Intel)
1971	Microprocessor	(Intel)
1971	EPROM	(Intel)
1977	Programmable Logic	(MMI)

The U.S. industry remains competitive today. Relative to sales, the U.S. chip industry leads all U.S. industries in its commitment to R&D, consistently spending about 10% of revenues on innovation.

Figure 2

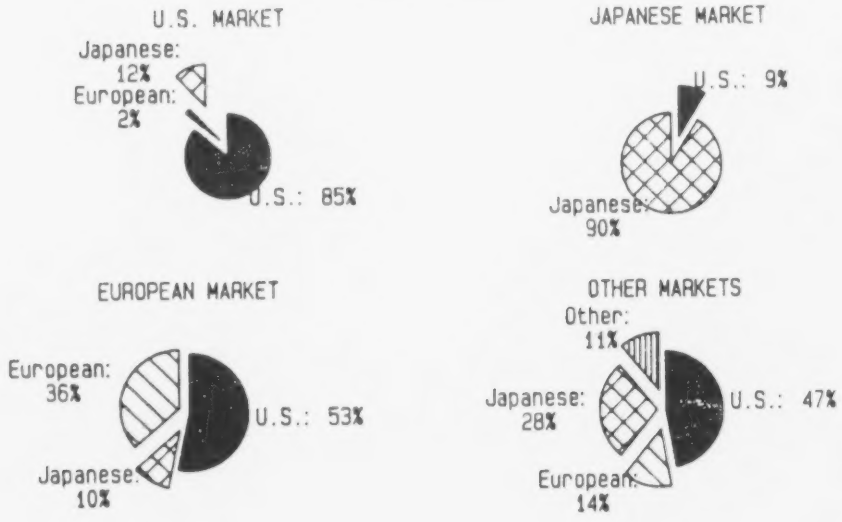
THE U.S SEMICONDUCTOR INDUSTRY IS AMERICA'S R&D LEADER
BUSINESS WEEK RANKINGS FOR PERCENT OF SALES ON R&D
1985

SEMICONDUCTORS	10.7%
SOFTWARE	8.3%
PHARMACEUTICALS	7.8%
COMPUTERS	7.7%
ELECTRONICS	4.4%
TELECOMMUNICATIONS	4.3%
AUTOMOTIVE	3.5%
ALL-INDUSTRY AVERAGE	3.1%
STEEL	0.5%

The U.S. semiconductor industry has outsold all its competitors in every world market, with the exception of the closed Japanese market.

Figure 3

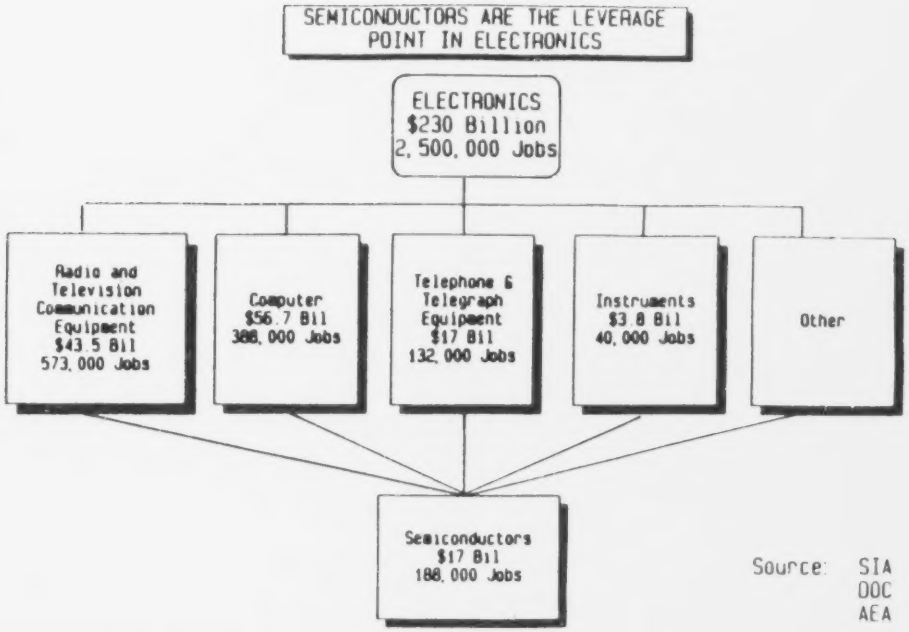
AVERAGE SEMICONDUCTOR MARKET SHARE
1982 - 1986



As will be discussed below, however, the United States position of technological leadership is seriously threatened.

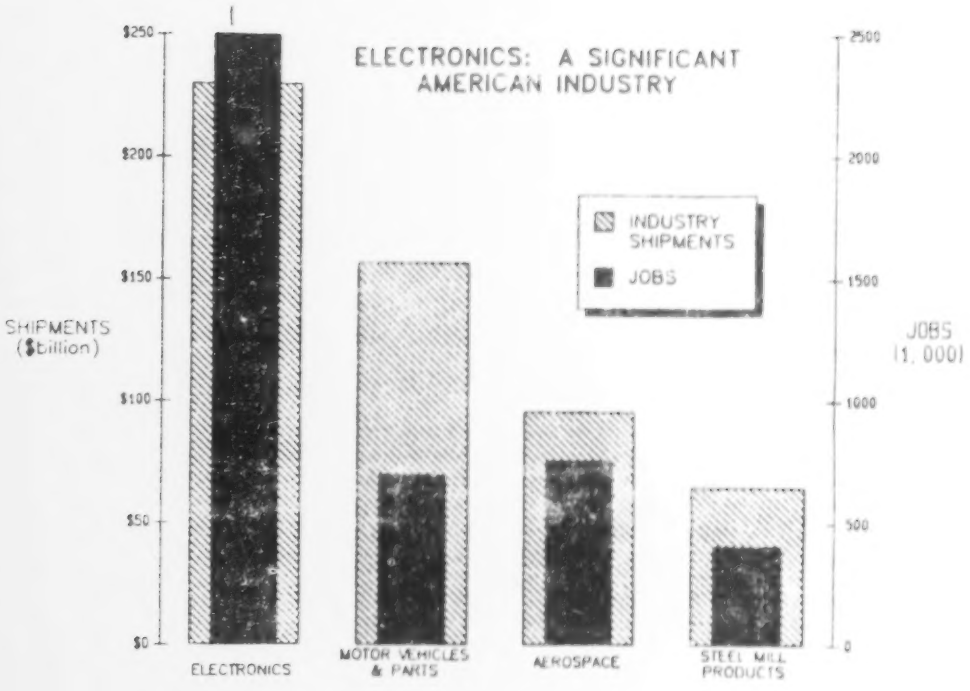
According to the Department of Commerce, the U.S. semiconductor industry represents 188,000 jobs and contributes $17 billion to GNP. The significance of the industry, however, extends far beyond these numbers. Microelectronic devices are the key components in computers, telecommunications equipment, instruments, and many other electronic products -- together representing $230 billion in sales and 2.5 million jobs.

Figure 4



Electronics is one of America's largest industries, both in sales and employment terms.

Figure 5

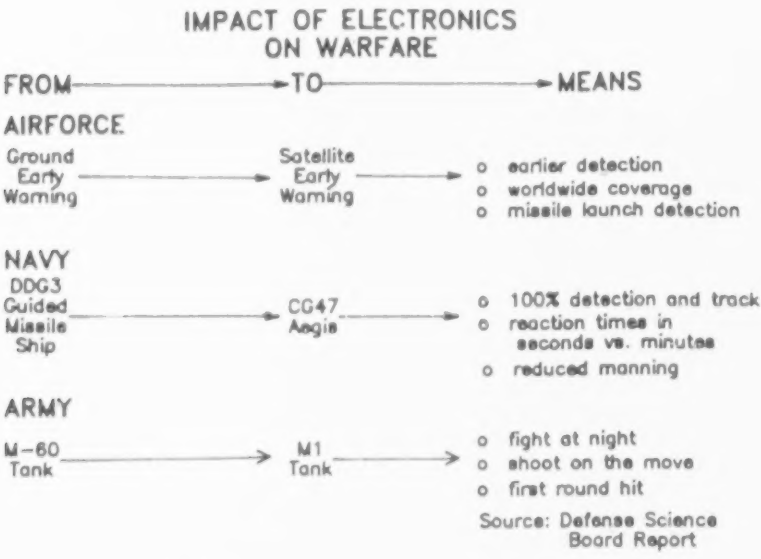


Semiconductors have had an impact beyond the electronics areas traditionally associated with microelectronics. According to Dataquest, Inc. the average semiconductor content value in a new automobile will double from $51 in 1983 to $105 in 1989. Semiconductor products will be utilized in ignition, fuel control, spark timing, anti-skid brakes, driver information displays, keyless entry, and perhaps four wheel steering. Home appliances, such as dishwashers, also have an increased semiconductor content to allow consumers to set the appliance's timing and to allow the machines to sense load changes and make appropriate adjustments, often with significant energy savings. The incorporation of semiconductors into these products increases their value added and the competitiveness of their manufacturers.

Semiconductors also have a leveraging impact on our national defense. Use of electronic technology permits additional military capabilities which the Defense Science Board Task Force on Defense Semiconductor Dependency has

concluded are necessary in many applications to offset Soviet numerical advantages.

Figure 6



Electronics now represent over 15% of the U.S. defense budget.

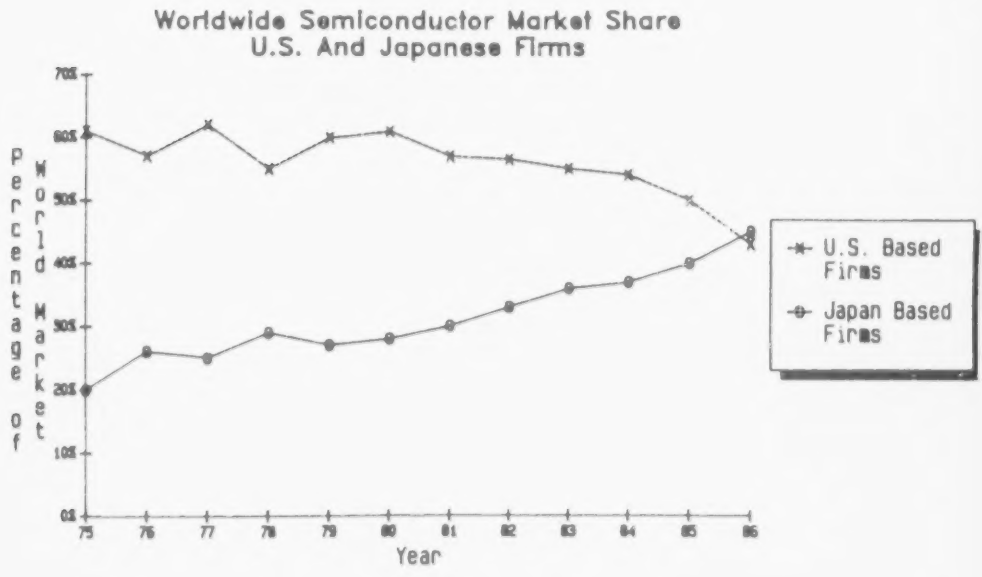
In short, semiconductors represent the key both to international competitiveness in the commercial sector and to national security. In establishing policies to enhance our national competitiveness and our national security, therefore, the maintenance of a healthy brand-based domestic semiconductor capability should be a fundamental priority.

II. THE COMPETITIVE CHALLENGE IN SEMICONDUCTORS

The U.S. semiconductor industry is a competitive industry which now faces a severe challenge from foreign competitors, principally from Japan.

The most important aspect of the U.S. merchant semiconductor industry's competitive situation is that the U.S. industry is no longer the world's largest. In 1986 U.S. merchant semiconductor companies slipped from the lead in worldwide market share.

Figure 7

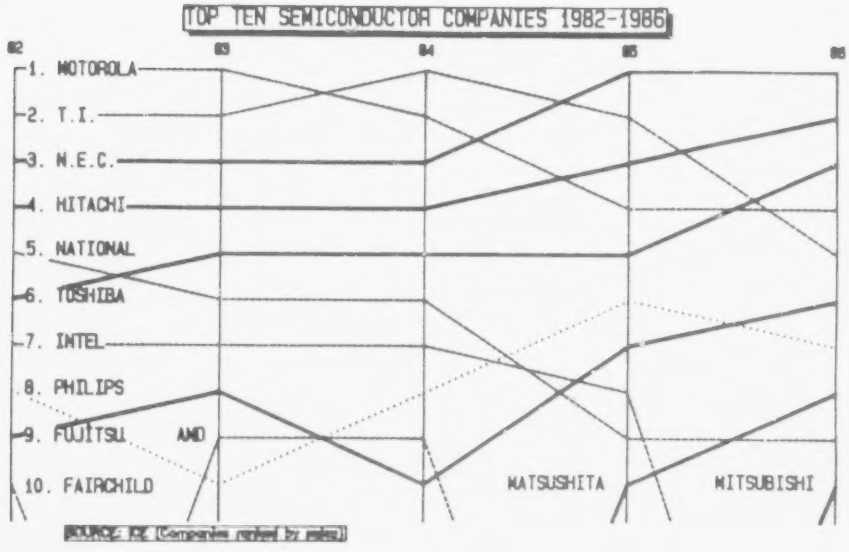


That position is now held by the Japanese semiconductor industry. European companies' market share has been declining slowly, while companies in the rest of the world -- predominantly in the Asia-Pacific region -- have recently become a significant factor in the marketplace.

The decline in the relative size of the U.S. merchant semiconductor industry is also evident from rankings of the

"Top 10" semiconductor merchants.1/ According to ICE the three largest merchant semiconductor companies in the world are now Japanese. American companies hold only three of the top ten positions.

Figure 8

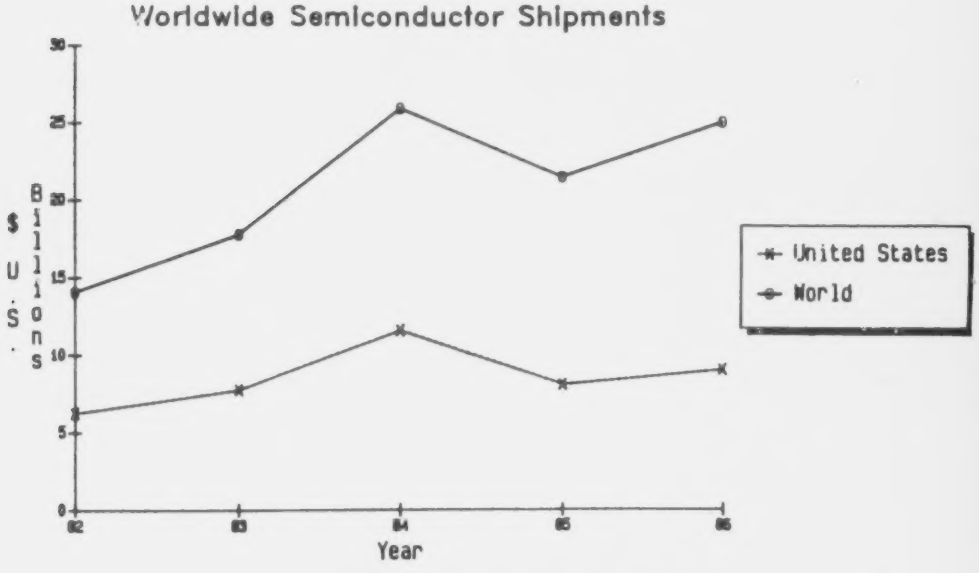


1/ A "merchant" producer is one which manufactures semiconductors for sale on the open market. By contrast, a "captive" producer manufactures semiconductors primarily for internal use.

In part, the 1986 loss of U.S. market share is a result of exchange rate shifts which greatly increased the dollar value of the Japanese semiconductor revenues, initially measured in yen. However, many economists would argue that current exchange rates more accurately reflect the underlying value of the U.S dollar than did the exchange rates of a few years ago.

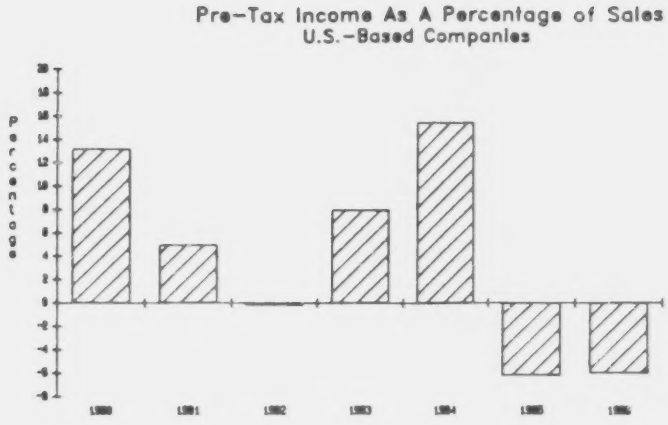
The problem for the U.S. merchant industry extends beyond a mere loss of market share. The industry has also suffered an actual decline in sales from its height in 1984. During 1985, U.S. companies' sales measured in dollar terms, declined approximately 30%. Sales rebounded slightly in 1986, but still remained far below 1984 levels. Figure 9 shows that world consumption mirrored the experience of the United States industry.

Figure 9



Not only have U.S. merchant companies' market share and absolute sales levels declined, but they have as a whole become unprofitable. During 1985 U.S. merchant semiconductor companies as a whole suffered losses equal to 6.5% of their sales.

Figure 10



During 1986, U.S. companies posted losses equal to about 6.1% of their sales.

Perhaps even more alarming than the U.S. market losses in semiconductors is the loss of U.S. leadership in semiconductor manufacturing equipment capabilities. What was once a U.S. lead in semiconductor technology and semiconductor processing equipment has dissolved into a trailing position in many areas.

Figure 11

STATUS AND TRENDS OF U.S. SEMICONDUCTOR TECHNOLOGY RELATIVE TO JAPAN

	JAPAN LEAD	U.S.-JAPAN PARITY	U.S. LEAD
Silicon Products			
DRAMs	<		
SRAMs	<		
EPROMs		•	
Microprocessors			<
Custom, Semicustom Logic			<
Bipolar	<		
Nonsilicon Products			
Memory	<		
Logic	<		
Linear			•
Optoelectronics	<		
Heterostructures	<		
Materials			
Silicon	<		
Gallium Arsenide	<		
Processing Equipment			
Optical Lithography		<	
E-Beam Lithography			<
X-Ray Lithography		<	
Ion Implantation Technology			
Chemical Vapor Deposition		•	
Deposition, Diffusion, Other		•	
Energy-Assisted Processing	<		
Assembly		•	
Packaging	<		
Test	<		
CAE		•	
CAM		<	

< U.S. Position Declining
• U.S. Position Maintaining

Source: Interagency Working Group on Semiconductor Technology

If this situation is not reversed, U.S. semiconductor companies will have to rely on Japanese-made equipment and will not necessarily have access to the best and latest equipment at the earliest possible time. U.S. captive producers, that is firms which produce semiconductors primarily for internal consumption, suffer as well as U.S. merchant producers by this loss of chip production infrastructure.

There are a number of reasons for the decline in fortunes of the United States merchant semiconductor industry.

First, the prolonged consumption slump evident in Figure 9 has affected U.S. companies more severely than it has affected companies from other nations (particularly those from Japan) because **the U.S. semiconductor market has been more depressed than any other market since 1984.**

Second, **a number of U.S. public policies hinder the competitiveness of U.S. semiconductor companies.** These policies range from tax policy to export control regulations, and will be discussed in the Competitive Agenda section below. In particular, it is imperative for the United States Government to recognize that U.S. export controls on West/West sales should be streamlined to eliminate any restrictions which place U.S. exports at a competitive disadvantage.

Third, in the United States, where virtually all semiconductor companies are publicly held corporations, the extent to which the interests of the shareholders are served -- and even the availability of equity capital -- is dependent on the return a company provides from quarter to quarter. This pressure makes it very difficult for managers of U.S. companies to emphasize programs which will be beneficial in the long term but which will result in short term limitations on profitability. **In Japan, by contrast, expected returns on short term investment are much lower than in the United States.** Japanese companies routinely report profit levels in the range of 3% or 4% even during good economic times. U.S. companies do not have this luxury.

Fourth, **foreign unfair trade practices have been a principle cause of injury to the U.S. semiconductor industry.**

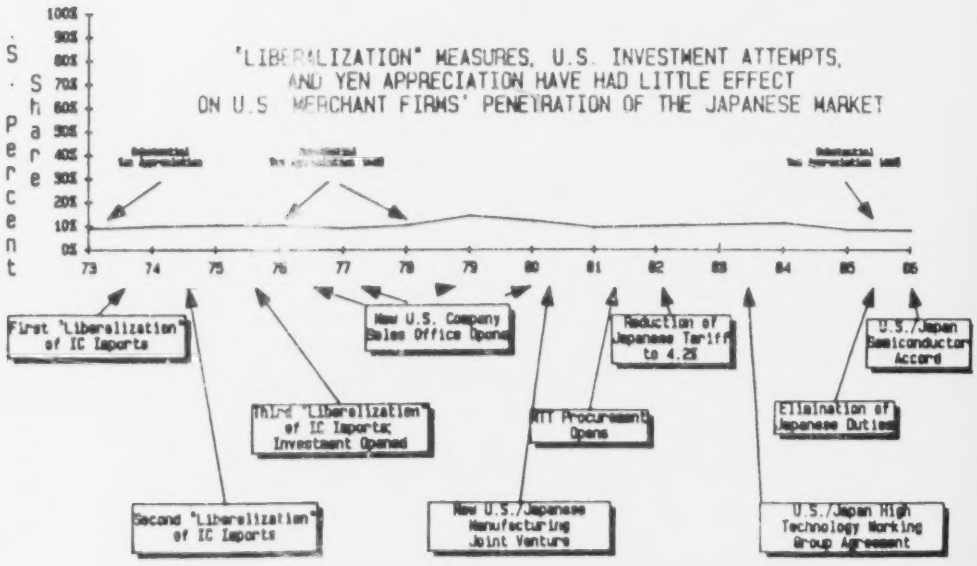
The United States and Japan recently signed an agreement concerning semiconductor trade. The Japanese Government and private sector actions which made this agreement necessary are extremely important factors in bolstering the competitive fortunes of the Japanese semiconductor industry at the expense of the U.S. industry.

The Japanese Government and Japanese electronics companies recognized during the late 1960s that a competitive position in the semiconductor industry would be essential to competitiveness in a full range of other manufacturing industries from telecommunications to computers to robotics. As a result, the Government of Japan restricted imports through quotas and high tariffs, and restricted foreign direct investment in the semiconductor industry in Japan. At the same time, the government encouraged Japanese companies to obtain state of the art (mainly U.S.) semiconductor technology.

In the early 1970s, the United States Government objected to this restrictive trade policy and the Government of Japan officially eliminated quotas and began to reduce its tariff barriers on semiconductors. By 1976, foreign investment was also liberalized. However, at the urging of the Japanese semiconductor industry, the Japanese Government simultaneously undertook "liberalization countermeasures" which offset the effect of the supposed liberalization effort.

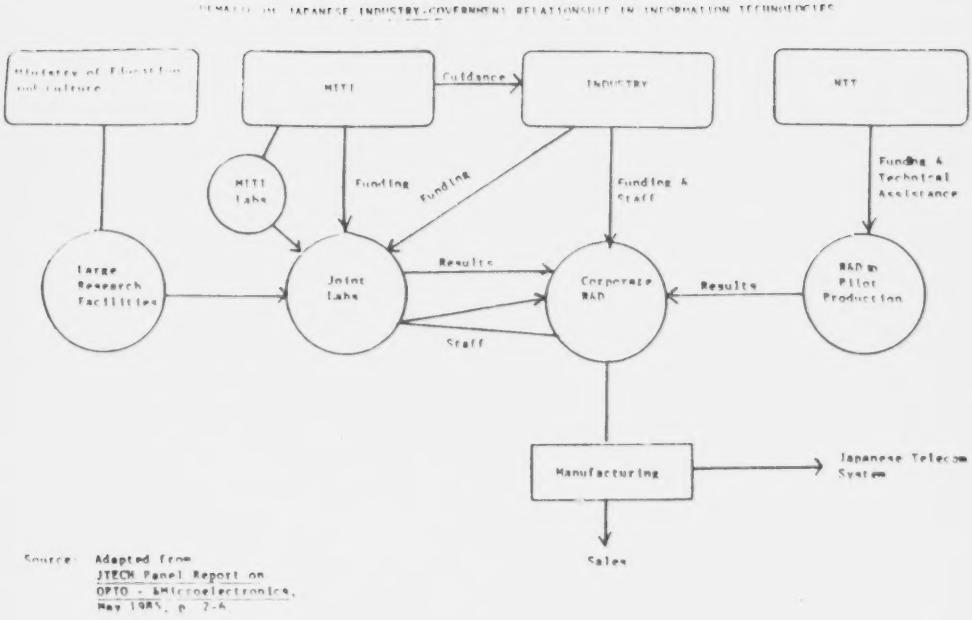
The liberalization countermeasures were effective. The U.S. share of the Japanese market has never gone beyond a level of approximately 10% despite numerous Japanese Government "liberalization" initiatives and several yen appreciations.

Figure 12



Also during the late 1970s, Japan's Ministry of International Trade and Industry coordinated an overall program for the development of the Japanese semiconductor industry. This involved direct funding, the support of Ministry of Education and Culture, Nippon Telephone and Telegraph (NTT) and MITI labs, and a series of joint industry-government semiconductor projects designed to promote the development of specific Japanese semiconductor manufacturers by boosting their technological and manufacturing capability.

Figure 13



Source: Adapted from JTECH Panel Report on OPTO - &Microelectronics, May 1985, p. 2-6

The most successful and widely known of these projects was the VLSI project which primarily developed memory technology -- particularly DRAM technology. The VLSI project's organization is outlined in Figure 14.

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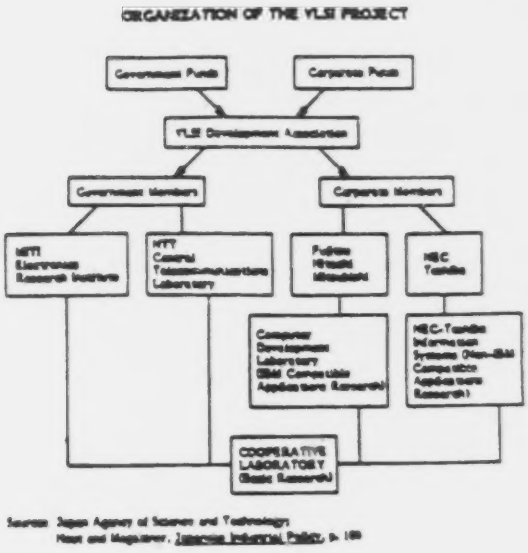
Figure 14

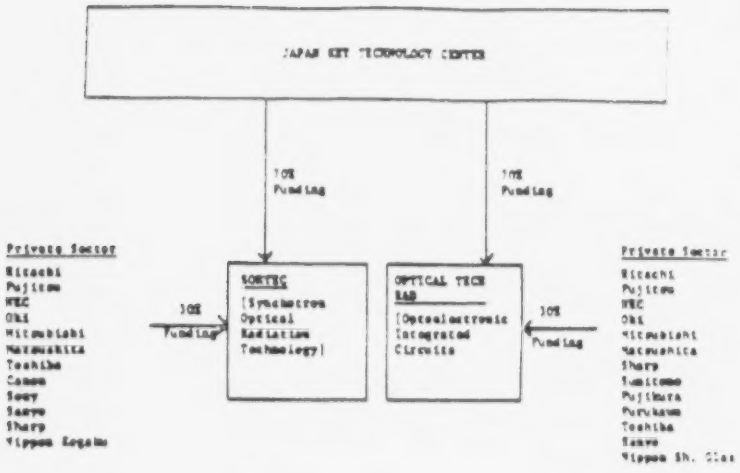


The basic relationship between the Japanese Government and the information industry is depicted schematically in Figure 14. MITI provides strategic guidance and financial assistance to industry, and jointly participates with Japanese companies in R&D for commercial applications in industry-government joint laboratories. NTT, under the jurisdiction of MPT, jointly designs telecommunications equipment with Japanese companies, who then produce the equipment for sale to NTT.

Japanese Government targeting of the microelectronics industry has not ceased. Most recently, the Japanese Government organized the Japan Key Technology Center, which is funding state of the art semiconductor research.

Figure 15

CURRENT MICROELECTRONICS INITIATIVE OF THE
JAPAN KEY TECHNOLOGY CENTER



Source: Nihon Keizai, May 8, 1986;
May 16, 1986

Other nations have noted the success of the Japanese Government programs for the development of the Japanese semiconductor industry, and have instituted similar programs.

Figure 16

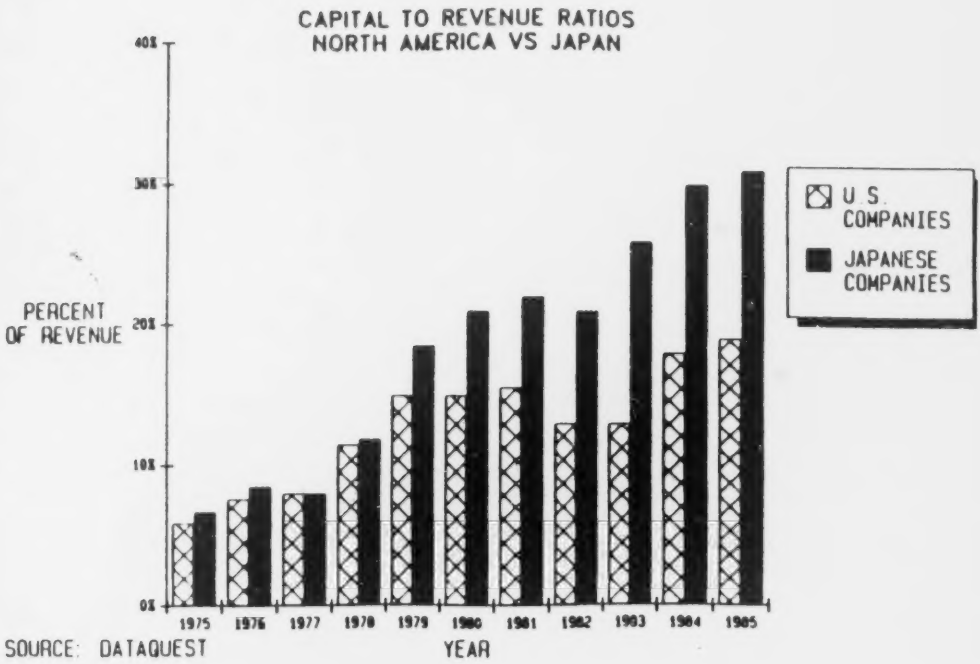
MAJOR GOVERNMENT-FUNDED R&D PROJECTS IN MICROELECTRONICS AND RELATED SECTORS

COUNTRY	PROJECT	TECHNICAL FOCUS	TIME FRAME	BUDGET ($MIL)
Great Britain	Alvey	Commercial Computing	1983-87	$ 500
European Communities	ESPRIT	Commercial Computing	1984-94	1,250
France	Filiere Electronique	Information Technologies	1982-86	5,000
Germany/Netherlands	Mega-Project	4M DRAM/1M SRAM	1984-89	2,000
Korea	4M DRAM	4M DRAM	N/A	N/A
Japan	Sortec	X-Ray Lithography	1986-96	100
Japan	Optroelectronic ICs	Optical microelectronics	1986-96	100
Japan	Supercomputers	High-Speed computing	1982-89	124

As Figure 16 indicates, the United States is one of the few technologically advanced nations which has not organized a government program for the development of semiconductor technology for commercial applications. The U.S. Defense Department has funded the Very High Speed Integrated Circuit (VHSIC) R&D program which seeks to improve semiconductors with unique military capabilities, such as radiation hardening, but this program is oriented solely toward military applications and the commercial use of VHSIC technology is prohibited.

Japanese government activity in the marketplace has affected the world competitive situation. The Japanese companies have been imbued with the sense that without a significant level of semiconductor production they would not be competitive in electronic production. As a result, they proceeded to invest in new semiconductor production capacity -- particularly memory capacity -- at rates which far exceeded the rate of increase in the semiconductor market as a whole. These investment rates also exceeded the investments being made by U.S. firms.

Figure 17



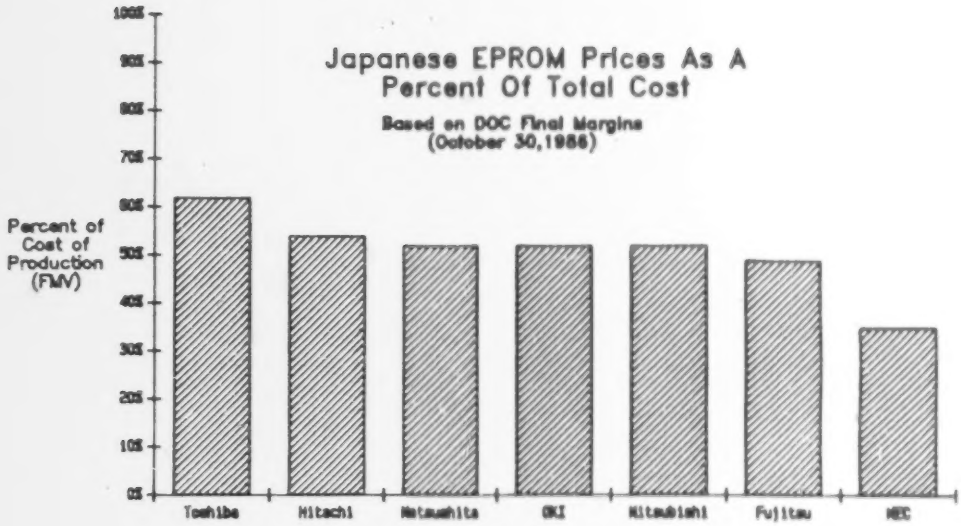
Japanese overinvestment continued through the early and mid 1980s, and continues today. Moreover, Japanese companies, once in, do not leave the semiconductor industry -- despite losing millions of dollars in their semiconductor operations.

Excess capacity in the industry has had the following results:

1. foreign access to the Japanese semiconductor market has continued to be limited because to open the Japanese market fully to competition from foreign companies would reduce the size of the largest single market in which Japanese companies dispose of their excess production;

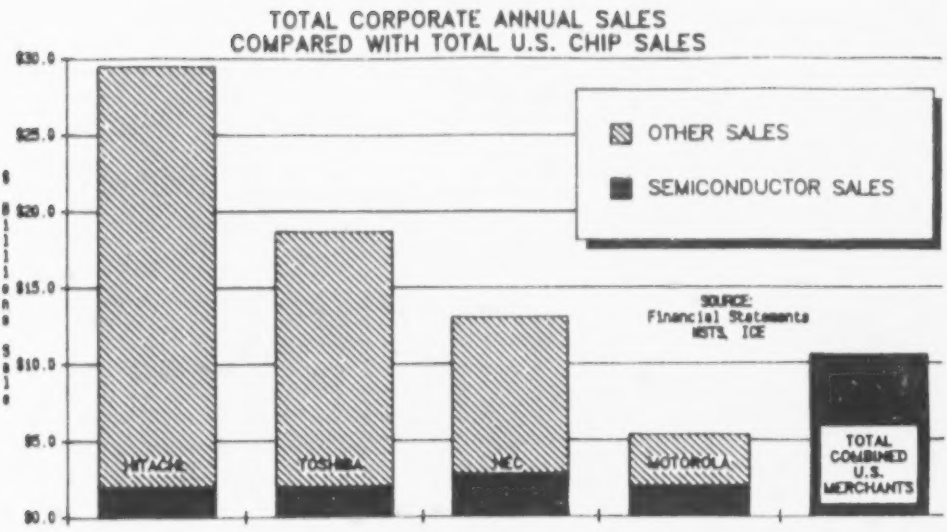
2. Japanese companies have dumped their excess production in all world markets -- selling semiconductors (especially memory semiconductors) at prices far less than their cost of production.

Figure 18



3. Japanese companies have had the financial resources to withstand continued losses to a much greater extent than their U.S. counterparts. Japanese chip merchants are part of larger firms producing electronics and other products. Figure 19 charts the overall corporate sales of the top 3 world semiconductor merchants; NEC, Hitachi, & Toshiba. In contrast, the two largest U.S. semiconductor merchants -- Motorola and Texas Instruments -- have total revenues which are only a fraction of their Japanese counterparts. In fact, the entire U.S. merchant semiconductor industry is smaller than either Toshiba or Hitachi.

Figure 19



The Japanese producers' financial position is further strengthened by their relationship with "family" groupings. For example, NEC is a member of the Sumitomo Group which includes banks, trading companies & firms in other manufacturing industries.

U.S. companies were driven finally to take legal action in 1985. Antidumping cases were filed in EPROMs, 64K DRAMS, and 256K and above DRAMs, and SIA filed a Section 301 market access case with the Office of the United States Trade Representative. In preliminary determinations in all of these investigations and final determinations in two, Japanese companies were found to be dumping by margins of up to 188%. The Section 301 Committee also determined that SIA had a legitimate case.

The Semiconductor Agreement, signed on September 2, 1986 is intended to subject Japanese companies to market forces so as to reduce the excess capacity situation in the semiconductor industry. In so doing, it should also halt the injury caused to the United States industry by unfair trade practices and should provide an opportunity for U.S.

companies and the United States Government to take those actions which are necessary to regain a leadership position in the semiconductor industry.

The Agreement resulted in the suspension by the U.S. Government of three trade cases without the imposition of any trade remedy. In return, the Government of Japan entered into three commitments.

Figure 20

THE SEMICONDUCTOR AGREEMENT

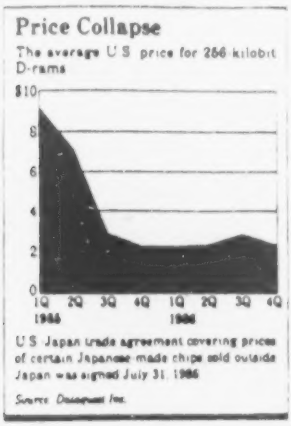
- o U.S. suspends trade cases
  - Section 301
  - 256K+ DRAMs
  - EPROMs
- o Japan commits:
  - To halt U.S. and 3rd market dumping
    - 256K+ DRAMs
    - EPROMs
    - Monitored products
  - To provide market access
  - Not to undercut agreement in Japan

Unfortunately, the Agreement has not yet been implemented effectively by the Government of Japan:

1. there has been no improvement in U.S. companies' access to the Japanese semiconductor market.

2. Dumping in third country markets continues.

Figure 21



Sourced from The Wall Street Journal; February 12, 1987.

3. There continues to be evidence that Japanese companies are selling at less than their cost of production in the United States.

III. A COMPETITIVE AGENDA FOR U.S. SEMICONDUCTOR LEADERSHIP

To reverse the trends described above, the SIA urges action on six fronts:

A. impose trade measures to enforce the trade agreement,

B. pass legislation aimed at multiple offenders of U.S. antidumping laws,

C. provide a tax code that stimulates R&D and investment,

D. protect intellectual property,

E. reform U.S. export control laws,

F. consider a program to strengthen U.S. semiconductor manufacturing capabilities.

The remainder of this paper discusses each of these items.

A. Impose Trade Measures to Enforce the Trade Agreement.

SIA believes that the faithful implementation of the commitments and objectives of the Semiconductor Agreement is the only effective means of addressing the twin problems of market access and prevention of dumping in semiconductor trade with Japan. However the Japanese Government has not fulfilled its commitments under the Agreement and is frustrating the accomplishment of the Agreement's objectives. Ample opportunity has been afforded over the last six months for the Japanese Government and the Japanese semiconductor industry to demonstrate their good faith, and U.S. companies have made substantial efforts to penetrate the Japanese semiconductor market. Figure 22 summarizes some of the U.S. company efforts to access the Japanese market during 1986.

Figure 22

U.S. Company Activities in Japan -- 1986

Nine design, test, or sales centers opened

Two companies open new subsidiaries

Three companies announce major expansions of their distribution networks

Sales related employment in Japan has increased about 10% from Q1 1986 to Q4 1986

Japanese producers have been the unjust beneficiaries of the Agreement. In return for a Japanese pledge to allow increased sales in the Japanese market and to avoid dumping, the Administration waived the imposition of dumping duties in two cases and suspended action under Section 301. During the last six months, collection of substantial dumping penalties against Japanese companies has been foregone. However, the injury to U.S. chip producers has not been remedied through implementation of the Agreement.

It is now both necessary and appropriate to impose trade measures against the products of Japan for several reasons: (1) to serve as an incentive for compliance, (2) to compensate the U.S. for the harm suffered by the American industry due to this failure to live up to the terms of the Agreement, and (3) to prevent further injury from dumping and denial of market access. Such measures should be aimed at enforcing the commitments and achieving the objectives of the Agreement both with respect to market access and the prevention of dumping in the United States and other markets.

Enforcement measures must be implemented immediately to remedy and prevent further violation of the Agreement. These measures should directly affect those companies acting inconsistently with the terms of the Agreement. These measures should be structured to avoid adverse effects on U.S. semiconductor users.

Effective immediately, the U.S. Government should impose measures designed to offset the sales lost from the continued denial of improved market access and the continuation of Japanese dumping. Moreover, the U.S. Government should establish a schedule for escalating those measures for every additional three month period in which Japan is not in substantial compliance with the terms of the Agreement.

B. Pass Legislation Aimed at Multiple Offenders of U.S. Antidumping Laws.

As Figure 23 demonstrates, many of the producers recently found to have dumped in the semiconductor industry were also found to have dumped in other electronics areas as well.

Figure 23

DUMPING MARGINS BY COMPANY AND PRODUCT

CASE	Matsushita	NEC	Kokusai	OKI	Hitachi	Toshiba	Mitsubishi	Fujitsu	Sanyo	Sharp
Large Power Transformers (1978)					21.40	51.37				
Televisions (1971)	74.82 Color (55.16) BW				58.42 (43.36)	32.34 (38.78)	52.73 (81.72)		76.83 (64.98)	61.88 (66.72)
High Power Amplifier Assembly & Parts (two types) (1981)		25.4% 41.4 41.4 (Parts)								
High Capacity Pagers (tone only) (1982)	189.86	70.35								
Cellular Radio Apparatus Transceivers & Subassemblies (1983)			59.94							
Cellular Mobile Telephone (1984)	186.60	95.57	57.81	9.72	2.99	0	87.83	57.81		
64K DRAM (1986)	28.75	22.76		35.36	11.87	28.75	13.43	28.75		
EPROM (1986)	93.90	188.0		93.90	85.20	60.10	93.90	183.00		
256K DRAM (1985) 1/	39.68	188.72		39.68	19.88	49.50	188.72 2/	74.35		

FOOTNOTES

1. Margins are preliminary.
2. Based on best information available.

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The high margins in these cases lead one to believe that dumping is not an accidental occurrence with these companies but rather an intentional business strategy.

SIA advocates legislation that will deter multiple violations of U.S. antidumping laws. Such legislation should incorporate the following:

1. After the first affirmative finding of dumping the U.S. Government would distribute the proceeds of any subsequent antidumping duties to the injured companies. With respect to the manufacturer of the dumped products:

    (a) at the request of any U.S. company, the Commerce Department would be required to monitor imports of products within the same product category where dumping is suspected;

    (b) if monitoring reveals sales at less than fair value, Commerce would be required to initiate a "fast-track" antidumping investigation;

    (c) Commerce would be required to find "critical circumstances" in any antidumping action brought against the manufacturer in the same product area;

    (d) the United States International Trade Commission would be instructed to take into account the effects of prior dumping in determining injury.

2. After the second affirmative finding of dumping against the manufacturer in the same product category, Commerce would be required to monitor the products of the manufacturer within the same product category, and initiate a fast-track antidumping investigation if monitoring reveals dumping.

3. After the third affirmative finding of dumping against the manufacturer in the same product category, additional actions would be taken. First, in any civil action for damages against the manufacturer under the 1916 Antidumping Act, a rebuttable presumption would be established that sales at less than fair value were made with the intent of injuring or destroying a U.S., industry

(no treble damages). Second, Commerce would institute broader monitoring of products within related groupings.

C. Adopt a Pro-Competitiveness Tax Policy

The 1986 tax act has a negative impact on the competitive position of the U.S. semiconductor industry. The chip industry had been a significant user of Investment Tax Credits (ITCs) as a result of the substantial capital investments in this high growth, rapidly changing industry. The loss of the ITC was the single largest blow to the competitiveness of the U.S. chip industry in the 1986 Act.

Limitations on the use of ITC carryforwards further damaged the U.S. industry. In order to remain at the state of the art, U.S. producers continued to invest despite suffering severe losses in 1985 and 1986, and thus built up ITCs which they were not able to use. The 1986 Act reduces the tax credit carryovers by 35%, with further restrictions for minimum tax purposes. Similarly, R&D credits earned during the chip recession cannot be carried over against the minimum tax.

On a more positive note, Congress extended the R&D tax credit, first passed in 1981, for an additional three years -- although at a rate of 20% rather than the previous 25%. Congress also established a new 20% basic research credit for company funding of university and research institute R&D. Congressional action extending the moratorium on implementation of IRS Regulation 861, which effectively encourages U.S. firms to perform R&D outside the U.S., was also positive, although the moratorium extension was for only one year. Finally, Congress passed a semiconductor manufacturing equipment depreciation rate which, while short of the combined ACRS depreciation and ITC provisions under prior law, were more favorable than ACRS alone.

A competitive tax environment for U.S. semiconductor production would include:

1. **Passing a permanent 25% R&D tax credit** to allow predictability for investments in projects which are typically of a long term nature. (S. 58, the Research and development Incentive Act of 1987, would accomplish this objective);

2. **Eliminating or effectively limiting the amount of R&D expenses which must be allocated to foreign source income.** (Section 861);

3. Shortening depreciation lives, particularly with respect to the minimum tax;

4. Offsetting pre-1986 R&D tax credit carryovers against the minimum tax;

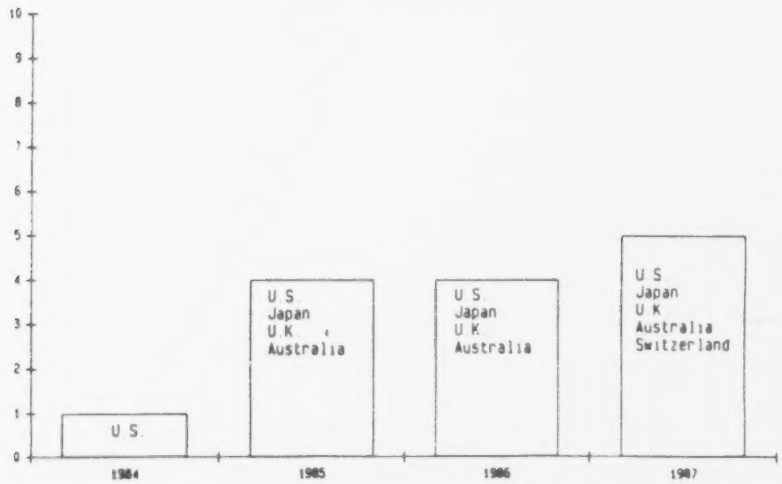
5. Returning lost ITC carryovers resulting from the 65% limit on ITC carryovers.

D. Protect Intellectual Property

In 1984 the Congress passed the Semiconductor Chip Protection Act, (SCPA) which provided the first intellectual property protection for a new technology outside of the traditional categories of copyrights, patents, and trademarks. Since the U.S. pioneered the protection of semiconductor chips, a number of other countries have, to varying degrees, followed suit. Figure 24 illustrates the speed at which foreign countries have moved to protect semiconductors. The rapid enactment of semiconductor intellectual property protection laws in foreign countries is due in large part to Section 914 of the SCPA, which provides protection for foreign designs in the U.S. if the foreign country protects U.S. designs in its jurisdiction.

Figure 24

NUMBER OF COUNTRIES CLAIMING
TO PROTECT SEMICONDUCTOR DESIGNS



To encourage the continued spread of chip protection worldwide on a basis equivalent to chip protection in the U.S., SIA supports the following:

1. **SCPA Interim order rollover** -- Under SCPA Section 914, the President's authority to issue interim orders expires on November 8, 1987. **SIA supports legislation to extend Section 914, require annual hearings under Section 914, and freeze Section 902 Presidential proclamations.**

2. **Section 337 Injury Requirement -- SIA supports the inclusion of the SCPA in any legislation which removes the injury requirement from Section 337 enforcement actions.** SIA testified last year in favor of this proposal, which nearly passed in the session's final days and is likely to be part of this year's omnibus trade bill.

3. **Korea** -- Resolution of the Administration's Section 301 intellectual property case against South Korea did not include provisions for the protection of semiconductor designs. Given the rapid growth of the Korean semiconductor industry, this is a matter of concern. **SIA urges the USTR and Commerce to ensure that the Korean Government is made of aware of U.S. interest in the rapid enactment of Korean chip protection legislation** through GSP reviews and other proceedings.

4. **World Intellectual Property Organization (WIPO)** -- WIPO has been working on a chip protection treaty. **SIA is continuing to work with WIPO and the U.S. negotiators to ensure that the U.S. will not become signatory to a multilateral treaty which does not meet the needs of the U.S. industry.**

E. Reform U.S. Export Control Laws

As part of the increased emphasis on international competitiveness, the Administration and the Congress are focusing greater resources on reforming current U.S. export control regulations and laws to reduce the competitive burden imposed by U.S. export controls. Particular attention is being given to those areas in which the United States imposes unilateral controls on exports to Free World countries. In addition, a National Academy of Sciences report on export controls that was highly critical of the current export controls system has increased the general awareness in the administration of reform of export controls as a competitiveness issue.

SIA's objectives are to obtain significant relief from the burdens of export controls, particularly with regard to West/West licensing requirements. In this regard, SIA supports the West/West Foreign Availability procedure -- that is, if a product is available outside the United States without restriction on export of the product to other Free World countries then the product, and all similar products with lower technical parameters, should be decontrolled for exports to Free World countries.

-- SIA supports the elimination of U.S. controls on foreign-origin end-products that contain a de minimis level of U.S.-origin components. Current reexport controls on U.S.-origin components incorporated in foreign-origin end products have given foreign manufacturers a strong incentive to avoid U.S. reexport controls.

Other provisions which SIA supports include:

1. Implementing provisions regarding spare and replacement parts;

2. Raising the performance standards for products eligible for the distribution license;

3. Raising the product levels for exports to the People's Republic of China;

4. Implementing a general license that permits exports to certified end users and that automatically qualifies government and government-controlled entities of COCOM countries as certified end users; and

5. Establishing a COCOM free license area to permit free exports and reexports of U.S.-origin items between and among COCOM cooperating countries.

F. Consider a Program to Strengthen U.S. Semiconductor Manufacturing Capabilities

The trend toward second-place status in chip production infrastructure, shown above in Figure 11, has alarmed people both within and outside of the industry. The Defense Science Board has recently recommended the establishment of a Semiconductor Manufacturing Technology Institute which would develop, demonstrate, and advance the technology base for efficient, high-yield manufacture of advanced semiconductor devices. In a separate but related action, the SIA Board of Directors formed a task force to determine if a

consensus exists for an industry-wide consortium to strengthen American manufacturing capabilities in semiconductors.

The SIA project, dubbed "SEMATECH" for "Semiconductor Manufacturing Technology", would develop and demonstrate semiconductor manufacturing technologies as advanced as any in the world, and transfer the manufacturing technology capability to U.S. manufacturers.

The SIA Board task force will be making its report shortly. SIA will be communicating to Federal policy makers its decision at that time.

IV. CONCLUSION

Global market conditions require the United States to increase its industrial competitiveness. The leveraging role that semiconductors can play in improving America's competitive position makes the U.S. semiconductor industry a critical national resource. The leveraging role that chips play in our national defense compounds the importance of the U.S. chip industry. Increasingly, the U.S. semiconductor industry is losing its leadership position in semiconductor technology to foreign parties.

A competitive agenda to maintain U.S. leadership in semiconductors is necessary. Such an agenda should include imposing trade measures to enforce the semiconductor agreement, passing legislation aimed at multiple offenders of U.S. antidumping laws, providing a tax code that stimulates R&D and investment, protecting intellectual property, reforming U.S. export control laws, and considering a program to strengthen U.S. semiconductor manufacturing capabilities.

U.S. Under Secretary of Defense Charles Fowler, after citing the importance of the U.S. semiconductor industry to the nation's economy and security, described the competitive challenge facing the U.S. semiconductor industry as "a critical national problem that at some time in the future may be looked upon in retrospect as a turning point in the history of our nation." The agenda presented in this document will enable the United States to meet this fundamental challenge.

Senator LEAHY. Mr. Cornell, you have been referred to throughout all the testimony. Here is your chance.

STATEMENT OF JONATHAN E. CORNELL

Mr. CORNELL. Thank you for the opportunity to speak to this committee, Mr. Chairman. I am Jon Cornell, from the Harris Corporation, and I am in charge of our semiconductor business. Today, though, I am speaking on behalf of the Semiconductor Industry Association, of which I am a Director, and more importantly as a member of the Steering Committee, which is addressing this very issue, and as a member of the Steering Committee that is involved in determining the destiny of this joint venture.

I would like to speak today basically in some detail about manufacturing technology and the fact that this indeed is the most serious competitive challenge that we face with Japan today.

In particular, as Bob and Norm have mentioned earlier, I would like to talk about the concept of a joint semiconductor project as a response to this challenge. Now, in my written testimony I have provided an overview of the role of the Japanese government in promoting the semiconductor industry in Japan to its position of world dominance.

Most importantly, though, I would like to focus on the fact that Japan has created a comparative advantage in semiconductor manufacturing and as a consequence has created a significant position of market dominance in the high-volume semiconductor products. Simply stated, the issue that we are discussing today is the matter of regaining competitiveness.

There are two essential aspects of semiconductor competitiveness which have been mentioned already. The first is innovation, largely around its products, and second, that of manufacturing excellence.

As Dr Noyce mentioned, in the area of innovation we have led the world and still do. All significant products in semiconductors have been invented in the United States and many of the general technological advances have come from the United States.

On the other hand, for a variety of reasons which I would like to speak to, in the manufacturing area we have fallen short. Basically, I think there are three causes behind this.

The first, which has also been mentioned, is the fact that semiconductor dumping by Japanese suppliers and the restriction of market access has basically put U.S. companies out of the high-volume semiconductor markets, and this has been a major blow to us as suppliers and the reason for that is that these high-volume markets basically involve products that we refer to as technology drivers, and it is through these high-volume products that we achieve production learning and it is through this production learning that we make possible the improvements in manufacturing technology. These manufacturing improvements then are applicable to all of our semiconductor business. So basically, through the loss of this high-volume market we have been denied the opportunity for learning.

The second factor that is important in this regard is the fact that the real cost of capital in the United States has been and still is

much higher than in Japan, and as a consequence Japanese companies have been able to maintain a high ratio of capital investments as a ratio to sales in U.S. companies.

One of the things that has come of this has been the fact that through this strong capital program in manufacturing equipment the Japanese have been able to establish a strong manufacturing infrastructure.

The third point, and really the focus of my discussion, has to do with the fact that while we as U.S. companies have certainly tried to reduce costs as rapidly as possible, the emphasis we have placed on manufacturing technology has not been as great as that that has been done in Japan.

Now, to date efforts to restore U.S. companies to leadership in manufacturing technology have been characterized by two problems, the first which I would label as entrepreneurial redundancy, meaning that we have had parallel efforts that have been inefficient in trying to develop manufacturing capability, and, second, a general lack of coordination between government, academia, and industry. Obviously, the situation regarding manufacturing has to be changed.

In this respect, during the past year, as Mr. Augustine and Dr. Noyce pointed out, both the Semiconductor Industry Association and the Defense Science Board have identified the need to enhance U.S. manufacturing capabilities through the establishment of a consortium in manufacturing involving U.S. based and U.S. owned companies, and the purpose of this consortium will be to develop, demonstrate and make available to U.S. companies the best in the world semiconductor manufacturing technology.

Now, this consortium which we are calling SEMATECH for Semiconductor Manufacturing Technology, would include participation by merchant semiconductor producers, captive semiconductor producers, manufacturers of semiconductor production equipment and materials and the U.S. government. This consortium would basically have about three time phases.

The first, which is what I would call the survival phase, would involve addressing some of the critical technological capability in manufacturing that we need to survive for the next several years. Also during this first phase we would define standards for future equipment, materials and processes, and we would then begin to demonstrate the manufacturing technology through a production facility that will be a part of this consortium.

In addition, we would focus on certainly a leadership product like the dynamic RAM as a technology driver to prove these capabilities. In addition, we could consider flexible production lines which would spin off these advances into other types of semiconductor products. Many, by the way, in this latter category would be ultimately used by the U.S. government.

The second phase——

Senator LEAHY. They would only be used by the U.S. Government?

Mr. CORNELL. No, some of these products would be manufactured on a flexible line would be the type that are used by the government, but not exclusively by the government, but we can come back to that.

The point though is we do have to focus on the technology driver, but then there is a mechanism of then taking this and addressing a broader array of products through what is called flexible manufacturing.

Now, this phase would probably take us through the remainder of this decade and would address the issue brought up, which is to make sure that we do not go down the tubes in the next five years.

The second phase, which I would characterize as the parity phase, would take place in the first several years of the nineties, and this basically would be a rebuilding of parity in manufacturing and we would do this through the development and implementation of next generation semiconductor equipment, materials, manufacturing methods and the like, and at this time we would then, of course, transfer this technology to the membership companies.

The third and final phase, which would basically occupy a time frame of about the middle nineties, would be what we would characterize as the leadership phase, and in this aspect the objective, of course, would be to regain leadership in manufacturing to assure U.S. technological competitiveness in the long term.

During this final phase, we would continue the projects that were begun in the first two phases and, moreover, we would transfer some of the significant research and development activities that we would propose to initiate through the universities, industrial laboratories and government laboratories back to the membership companies.

Now, during each phase of this project, we would address increasingly complex integrated circuits. To size this issue for you, in the first phase the target kind of product would be a 4 megabit DRAM. In the second phase, it would probably be something like a 16 megabit DRAM, and then in the final or leadership phase it would address something of the complexity of a 64 megabit DRAM.

Now, I would emphasize that during this activity we would be basically taking this technology from the driver kind of products such as DRAM and transferring it to a broader base of products.

Now, a number of issues remain to be resolved regarding the SEMATECH activity. This includes the organizational structure. It is clear, though, for example, that this would be a nonprofit organization. Its objection would not be production for commercial application but for development and manufacturing technology to be transferred to the member companies.

The funding issue, in round numbers it is going to take something like $200 million plus a year to fund this activity. The role that government would take in this, the site selection, staffing, antitrust issues, and so forth, so a number of concerns have to be dealt with.

The point here I guess is that the program such as this Sematech joint manufacturing initiative, this is the basis by which we can indeed put the United States back into a leadership role, we can enhance and preserve the infrastructure in this country and establish manufacturing excellence.

I would point out that this program may also well serve as a role model for other industries in a similar situation in this country for the future. It is my view that as a result of this and related activities that Dr. Noyce and Mr. Augustine have referred to, it is clear

that the U.S. semiconductor industry is either going to become the next victim or the first survivor of the economic assault by the Pacific rim.

Thank you very much.

Senator LEAHY. Thank you. And I also want to welcome Senator Humphrey, the ranking member of this subcommittee.

Did you have a town meeting today in New Hampshire today, too?

Senator HUMPHREY. No.

Senator LEAHY. I was just trying to figure out where everybody is today.

Mr. Cornell, I understand your written testimony to say, that the efforts to try to get U.S. companies in a leadership position in semiconductor manufacturing technology, are characterized by a redundant use of entrepreneurial resources, the general lack of coordination between the government and academia and industry. Is that right?

Mr. CORNELL. That is correct.

Senator LEAHY. Suppose we allowed the industry to pool its resources—in the past, I have supported changes in the basic thrust of our antitrust legislation, as you probably know, to do just that, especially in the R&D area.

Mr. CORNELL. Yes.

Senator LEAHY. But suppose we allowed the industry to pool its resources, allowing them to coordinate by loosening antitrust restrictions. Would the industry then be able to compete or is it still going to need federal funds, and probably the strings that come along with federal funds?

Mr. CORNELL. Well, let me answer those. There are two parts to that question. It is our belief that indeed such a pooling of resources would indeed make us competitive. The point on the entrepreneurial redundancy is that by eliminating that we will become much more efficient in the utilization of resources to attack the problem.

Now, there is some evidence that would suggest this kind of consortium will work. Semiconductor Research Corporation is an example of that. The Microelectronics and Computer Corporation is another example of that, where consortium activities seem to be effective.

The issue here is we are addressing a different subject matter. Those activities are primarily associated with what I would call product technology. Here we are speaking about manufacturing technology, and I believe we can be equally successful with this venture in accomplishing a restoration of competitiveness.

Regarding the issue of government funding, as you may be aware, the U.S. industry as a result of the problems that we have been describing today has suffered considerable financial loss in the last several years, perhaps on the order of a billion dollars or so of after-tax loss.

Clearly, it is the intention of the industry nonetheless to be supportive on their own behalf. We expect to be a major contributor of funds, perhaps half of the funds that are necessary to implement the Sematech activity. We do feel though, because of the magnitude of the task, that it will probably require in excess of $200 mil-

lion a year to operate, that we will need assistance from the U.S. government in that behalf.

Regarding the issue of the strings, on the one hand some strings are desirable because we certainly have an interest in the defense effort and the vital role that semiconductors play in that, that Mr. Augustine has referred to in his report.

On the other hand, clearly this activity has got to be free from what I would call micro-management. In that respect, we would propose certainly having involvement of the government, the national laboratories, that is a resource that I agree with you is of considerable value to this effort.

In terms of what you might call management involvement, I would think something in the form of an oversight activity would be appropriate. One model that we consider as a possibility would be something like the predecessor of NASA, the NACA, which was an oversight activity that still allowed the industry to basically solve its own problems to get on with this business without too many strings and red tape.

Senator LEAHY. But you do not think there is anybody in your industry, no matter what we did with the antitrust laws or anything else, that would take on Sematech by itself?

Mr. CORNELL. We have considered that. I am aware of the fact that there have been several alternatives other than this suggested. One, of course, was perhaps the government itself could establish a manufacturing entity. I think historically that certainly has not been a strength that the government has demonstrated, that is, manufacturing.

Another possibility might be for one or more large American private industry concerns to take on the problem. The issue there is that the technological base of any given company is not sufficiently broad to deal with the whole problem and certainly deal with a broad enough technology base to satisfy the defense efforts.

Secondly, if we do not maintain the viability of the entire U.S. merchant industry, the reduction in market share and volume will result in failure of the infrastructure and not sufficient volume to support the equipment and material, the toolmakers and so forth, and so we would have a failure in the infrastructure which would then cause all of this to fail by strangulation.

Senator LEAHY. That is not an attractive scenario.

[The statement of Mr. Cornell follows:]

Testimony of
JON E. CORNELL

on behalf of the
SEMICONDUCTOR INDUSTRY ASSOCIATION

Mr. Chairman, I am Jon Cornell, Senior Vice President and Sector Executive of Harris Corporation's Semiconductor Sector. I am testifying today on behalf of the Semiconductor Industry Association of which I am a member of the Board of Directors.

Dr. Noyce's testimony has focused on the overall importance of the U.S. semiconductor industry to our economy and our national security. He has described the Semiconductor Trade Agreement with Japan, and proposed some public policy steps which can enhance the competitiveness of the U.S. semiconductor industry. In my testimony, I will go into some additional detail concerning the particular technologies in which the United States now trails Japan. I will conclude by providing some thoughts on steps this country can take to remedy that situation from a technological perspective.

In examining the technological areas in which U.S. companies trail Japanese companies, it is useful to keep in mind that increased Japanese technological capability in the semiconductor area has been a goal of the Japanese Government since the 1960s. As a first step toward this goal, the Japanese Government restricted foreign companies' access to the Japanese market and limited foreign investment in the semiconductor industry in Japan. This created a secure base of semiconductor demand sufficient to support the Japanese industry while it became competitive with foreign companies.

Preferential procurement by NTT and the Japan Electronic Computer Company (JECC) provided a further basis of secure demand for Japanese semiconductor manufacturers.

Second, by designating semiconductors as a priority industry and by providing direct government loans at preferential rates to the largest Japanese electronics companies -- all of whom are members of vast industrial groupings -- the Japanese Government encouraged the additional flow of private sector funds into the semiconductor industry. In more general terms, real interest rates in Japan have for many years been lower than in the United States due to factors such as a high personal savings rate. This ensured the availability of a large pool of low-cost capital for all Japanese industries. At the same time, capital controls also kept the value of the yen generally at a lower level than would be required to bring Japan's manufacturing trade account into balance. Thus, all of Japanese society was essentially subsidizing Japan's industrial base. Because it had been targeted for growth, Japan's semiconductor industry enjoyed an even more advantaged position.

Finally, the Japanese Government and the then government-owned telecommunications company, NTT, initiated a series of joint research and development projects in the semiconductor industry during the 1970s and 1980s. These projects were very successful in developing state-of-the-art technologies and providing that technology to all participants in the venture for commercialization. Participation

in these projects was generally limited to the same few large electronics companies.

The most successful of the government R&D programs was the VLSI project in which semiconductor memory technology was developed. This program propelled the five participating Japanese companies into a competitive position in Dynamic Random Access Memories (DRAMs), Static Random Access Memories (SRAMs) and Erasable Programmable Read Only Memories (EPROMs). It also initiated a capacity expansion race in these products between the Japanese companies.

The subsequent success of the Japanese companies in the memory area of the market is primarily a result of these companies' dumping. However, the dumping would never have been possible had not the initial R&D programs first made the technology available.

Today, Japanese companies hold technological leads over U.S. companies in a number of centrally important technological areas. Most importantly, Japanese companies have achieved an enviable semiconductor manufacturing capability. This involves such factors as economies of scale, leading edge infrastructure (among equipment and materials suppliers), and simply a high degree of attention to the manufacturing process as a vital parameter of competitiveness. In addition, Japanese companies now hold positions of market dominance in such high volume semiconductor parts as DRAMs and bipolar memory and are leading in the development of new generation optoelectronic chips. In the optoelectronic

FIGURE 1

STATUS AND TRENDS OF U.S. SEMICONDUCTOR TECHNOLOGY RELATIVE TO JAPAN

	U.S. LAG				U.S. LEAD		
	SUBSTANTIAL	CLEAR	SLIGHT	PARITY WITH JAPAN	SLIGHT	CLEAR	SUBSTANTIAL
Silicon Products							
DRAMs		<	♦				
SRAMs		<	♦				
EPROMs				<		♦	
Microprocessors						<♦	
Custom, Semicustom Logic					<	♦	
Bipolar		<		♦			
Nonsilicon Products							
Memory			<		♦		
Logic			<			♦	
Linear					♦<		
Optoelectronics	<		♦				
Heterostructures		<	♦				
Materials							
Silicon			<	♦			
Gallium Arsenide		<			♦		
Processing Equipment							
Lithography							
Optical				<	♦		
E-Beam					<	♦	
X-Ray				<		♦	
Ion Implantation Technology						<♦	
Chemical Vapor Deposition				♦<			
Deposition, Diffusion, Other				<	♦		
Energy-Assisted Processing*			<				
Assembly				♦<			
Packaging		<♦					
Test			<		♦		
CAE				<			♦
CAM		<			♦		

* N/A in 1979 - 1980

♦U.S. Position 1979 - 1980 (1Q)
<U.S. Position 1986 - 1987 (1Q)

area, the Japanese Ministry of International Trade and Industry is currently sponsoring a joint R&D program.

Figure 1 provides a more detailed picture of the ascendancy of Japanese companies in semiconductor technology. As is clear from this figure, the United States semiconductor industry faces a serious competitive challenge. Our success in reestablishing a clear U.S. lead in a broad range of fundamental semiconductor technologies will have a profound impact on the ability of this country to achieve its national security goals and remain competitive in the electronics industry in the long term.

In his testimony, Dr. Noyce outlined a number of specific public policy proposals supported by the Semiconductor Industry Association which would enhance the overall competitiveness of the U.S. semiconductor industry. Among those important proposals, Dr. Noyce suggested that the United States enter into a joint program between the government, academicians and industry to enhance our semiconductor competitiveness. It is on this specific proposal which I will focus.

There are two essential aspects of enhancing semiconductor competitiveness -- product innovation and manufacturing excellence. United States semiconductor companies have traditionally stood out in product innovation:

- U.S. companies have been the first to introduce nearly every major new type of semiconductor product.
- R&D has received the greatest degree of attention in university electronics programs in the United

States, and the brightest U.S. electronics graduates have tended to seek out positions doing R&D.

- U.S. companies have invested heavily in R&D. The U.S. semiconductor industry spent 10.7% of its sales revenues on R&D during 1985. This is the highest ratio of R&D to sales of any U.S. industry.

For these reasons, U.S. companies' capabilities in product innovation remain strong. The infrastructure, the knowledge and the technical base for the conduct of semiconductor R&D are well established in the United States.

The area in which United States semiconductor companies face the greatest competitive challenge is in manufacturing. While U.S. semiconductor companies have always sought to reduce production costs as rapidly as possible, the relative importance attached to manufacturing technologies in the United States has generally been less than in Japan. Compared with R&D, U.S. universities have traditionally paid less attention to manufacturing technology and top engineering graduates have seldom sought manufacturing-oriented jobs.

Moreover, manufacturing technology can best be improved through volume production of a single semiconductor product. Such products are referred to as "technology drivers" because through the repeated production of these semiconductors it becomes possible to develop and perfect manufacturing technologies applicable to many other types of semiconductors. Defects in the manufacturing process which might not be readily apparent at a production level of 1,000 units

per month can become obvious at a production level of 100,000 units per month.

As Japanese companies increased their sales of technology driver semiconductor products -- particularly DRAMs -- they were able to take advantage of these learning benefits to further improve their manufacturing capabilities. U.S. companies, by contrast, could not sustain the losses which Japanese dumping was forcing on them and only three U.S. companies currently sell DRAMs on the open market. This places U.S. merchant semiconductor companies at a comparative disadvantage in manufacturing technology as compared with Japanese producers.

As a final factor, Japanese companies' access to debt capital at a lower real cost than debt financing is available to U.S. companies has resulted in a further comparative disadvantage for U.S. companies in manufacturing technology. The lower cost of capital has enabled Japanese companies to sustain a higher ratio of capital expenditure to sales than U.S. companies have been able to sustain. This means that Japanese companies frequently have been able to purchase state-of-the-art manufacturing equipment in higher quantities than have U.S. companies.

This, in turn, has supported the development of a very competitive infrastructure for semiconductor manufacturing. Japanese companies in many semiconductor technologies already are or are becoming the state-of-the-art trend setters. This is true in packaging, computer aided

manufacturing, testing equipment and energy-assisted processing. Six years ago, U.S. companies held a leadership position in all of these technologies with the exception of packaging.

In short, Japanese companies, bolstered by government-sponsored programs and the volume of production benefits linked to a strategy of semiconductor dumping, pose a very serious competitive challenge to the U.S. industry in manufacturing technology. To date, efforts to restore U.S. companies to a leadership position in this area have been characterized by redundant use of entrepreneurial resources and a general lack of coordination between the government, academia and industry.

During the past year, however, the threat I have described has been identified both by SIA and separately by the Defense Science Board. Working independently, both groups have concluded that a consortium of U.S.-based and U.S.-owned semiconductor manufacturers should be formed to develop, demonstrate and make available to U.S. companies best-in-the-world semiconductor manufacturing technologies. SIA's Board of Directors has not yet made the final decision to form such an organization, nor is its form fully defined, but there is virtually unanimous agreement throughout the U.S. semiconductor industry and the industries which supply semiconductor production equipment and materials, that this approach should be pursued.

The objectives of the consortium would be to:

1) preserve and enhance the U.S. semiconductor infrastructure -- that is the knowledge base and industrial base required to carry out state-of-the-art semiconductor manufacturing in the United States;

2) achieve world-class manufacturing competitiveness; and

3) provide advances in state-of-the-art process technology to participants.

SIA is tentatively calling the consortium SEMATECH for Semiconductor Manufacturing Technology. Members would contribute or sell baseline technology to SEMATECH and receive access to new technologies and manufacturing process developed by SEMATECH.

As presently envisioned, participants in the consortium would include merchant and captive semiconductor manufacturers, manufacturers of semiconductor production equipment and materials, and the U.S. Government. Over an eight year period to 1995, SEMATECH would pass through three distinct phases.

During the remainder of the 1980s, the consortium would build on the efforts already underway through the Semiconductor Research Corporation to take the steps necessary to maintain the United States' current technological capability relative to foreign competitors. This would involve the development of industry standards for production tools and equipment and the demonstration of manufacturing technology through production lines for commodity products -- perhaps DRAMs. Also at this stage flexible production lines could be created on which the advances achieved in high volume

production could be applied to lower volume products such as Application Specific Integrated Circuits (ASICs).

By 1990 SEMATECH would enter a second phase during which the objective would be to rebuild the U.S. ability to compete in a full range of semiconductor technologies. During this phase, SEMATECH would develop next generation semiconductor production equipment, manufacturing processes and manufacturing skills.

Finally, in a third phase beginning in 1993, SEMATECH would establish a firm basis for long term U.S. technological leadership. In addition to the continuation of the programs of phases one and two, during this third phase, major research programs would be established using industry, university and government laboratories.

During each phase of the project, SEMATECH would manufacture semiconductors of a greater complexity. For instance, the consortium might manufacture 4 megabit DRAMs during phase one, 16 megabit DRAMs during phase two and 64 megabit DRAMs during phase three.

A number of issues remain to be resolved before SEMATECH becomes a reality. Among them are the development of an organizational structure, funding, the specific role which will be played by the government, site selection, staffing, and antitrust concerns. This committee may be particularly interested in the antitrust aspects, and we look forward to working further with this committee on this issue as SIA further defines SEMATECH.

The intention of the SEMATECH concept is to maintain a fully competitive U.S. presence in the semiconductor industry into the next century and thereby maintain true competition in the semiconductor industry. The alternative may well be for the United States to become ever more reliant on semiconductors developed and produced by Japanese companies.

In conclusion, the committee should note that semiconductors are not the only U.S. manufacturing industry which is threatened with extinction due to foreign competition. Semiconductors may be a more dramatic example than most industries because we represent exactly the type of manufacturing which many expected would provide a new industrial base for this country. Now there is a very real threat to that expectation. Unfortunately this country is experiencing a general loss of its industrial base -- a loss which threatens virtually all manufacturing industries. At stake is the long term standard of living of the American people. The alternative of a service-based economy would not only be unbalanced and equally vulnerable to foreign competition, but would result in lower wage levels.

It is through an economy with a significant manufacturing sector that the United States can best provide for ongoing economic growth. Programs such as SEMATECH can create the technology and preserve the infrastructure necessary for manufacturing excellence and can serve as a flagship case for other industries in this country which seek a constructive response to foreign competition.

Thank you very much, Mr. Chairman, for this opportunity to testify before your committee.

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Senator LEAHY. I am going to address my next question to Mr. Augustine and Dr. Noyce and you, Mr. Cornell, starting with Mr. Augustine, because it is the kind of foreign policy issue that is going to have to be seriously considered.

How do you think the Japanese government is going to react to a project subsidized by the U.S. government aimed directly at important Japanese industry?

Mr. AUGUSTINE. Of course, I do not really know how they would react. I only know that, short of taking some action of this type we very likely will lose our ability to build state of the art semiconductors domestically.

I would also say that, from the Defense Science Board's standpoint, we really are not talking about a subsidy in the classic sense. We believe the Department of Defense needs access, domestic access, to very advanced semiconductors, in order to carry out its mission. We believe that it is in DOD's interest in the interest of defensive requirements, to support this or some other arrangement that assures the survival of that industry.

So, in our minds, we really are not talking about a subsidy. In terms of how Japan would react, I guess I would say more out of admiration than anger. The Japanese have brought their government, their industry, and their academic institutions together very effectively, in what I think has been an ingenious approach to capture a major piece of business. This is an unusual circumstance. You have an entire information industry, computers, telecommunications, and so on that depend on a single device which in itself is relatively inexpensive. But if you do not have them, if you do not have the latest chips, you cannot deliver the latest computers or the latest satellites and the latest aircraft for the military.

So I think they are not targeting only the semiconductor industry. I think they are interested in the information industry, and the semiconductor industry is a means to that end. Further upstream, the manufacturing equipment industry is another level of the iceberg.

So I think, rather than be offended, Japan might be surprised that it has taken us this long to figure out what the answer was.

Senator LEAHY. Dr. Noyce?

Mr. NOYCE. First of all, I think that this has more to do with the restoration of parity, rather than a subsidy for this industry. The Japanese have had several major programs with government and industry cooperation to establish their position in this industry, and in my written testimony that has been gone over on pages 13 through 16. On page 17 I mention the other major government funded consortia in Europe and Korea, as well as Japan.

We admire much that the Japanese have done. We think that they have done many of these things correctly in terms of the way they have put forth their industry. Many of the actions that they have taken in their own country would have been illegal in this country in terms of the intra-industry cooperation.

The part that we disagree with in the actions of the Japanese are the fact that they have worked from a closed market and that they have clearly been dumping on the world markets. Those parts we have to stop. The other parts I think we should emulate. I do not think that Japan will view that negatively.

Senator LEAHY. Mr. Cornell, do you disagree?

Mr. CORNELL. I would agree. Imitation is the sincerest form of flattery and I cannot hardly see how they would take issue with us on that.

Senator LEAHY. They might not feel overly flattered, though, when they see the end result as being a very competitive one.

Mr. CORNELL. Perhaps not, but I think they recognize that it is a competitive business. Certainly, what we proposed to do, and I think it is important to make a distinction that Dr. Noyce made, in terms of things like market access and dumping and those kinds of things, we feel that Japan is operating very inappropriately.

In terms of developing a competitive advantage in manufacturing, in a sense they are certainly to be commended. They have done an outstanding job there and they have done this through this form of cooperation with support and coordination by the government and to the extent that it fits our situation we should and will emulate that.

Senator LEAHY. Before I yield to Senator Humphrey, Mr. Augustine, I want to ask you a question. I remember sitting here 12 years ago or 13 years ago as a new Senator listening to a request from the Department of Defense that we rush forward with some money for the B-1 bomber, a high-flying supersonic plane that could swoop down at the last minute and fly at a low level. We absolutely needed it or we were going to fall behind the Soviet Union and others. They told us all the different things the plane would do.

Now, the B-1 bomber in many ways has turned out to be a "flying Edsel." It does not fly high, it does not fly fast, and when it swoops down low its offensive and defensive radars cannot work at the same time. It generally does not do any of the things we were told it would when we were being asked for the project's startup money.

Much of what I hear about Sematech appeals to me, but one of the reasons for these hearings is to find out whether we are going to run into a B-1 bomber here, whether we are going to end up putting a lot of money in and not get what we are told we are going to get.

How did the task force come up with this proposal for the initial capitalization of $250 million or even $1 billion over the next 5 years? Where did those figures come from?

Mr. AUGUSTINE. The proposal to set up a Semiconductor Manufacturing Technology Institute is by no means a sure thing. I should make that very clear, speaking from the standpoint of the Defense Science Board. The industry is probably behind today in many respects and it is losing ground, and it is not at all clear that we can turn it around. We think we can. We think it is so important that we have to try.

Where does one get the estimates of what it costs to undertake these projects? In terms of the Defense Science Board, the estimates are quite rough and would require a good deal of refinement.

Senator LEAHY. Do you mean the $250 million and the $1 billion?

Mr. AUGUSTINE. Yes, absolutely. They are what we would call rough order of magnitude estimates of what we judge would be a reasonable amount of money to undertake what we have proposed.

There was no detailed line by line analysis that led to that. That remains to be done.

Senator LEAHY. Do you know how the Defense Department came up with their $250 million request?

Mr. AUGUSTINE. No, I do not. I am sorry.

Senator LEAHY. Gordon?

STATEMENT OF HON. GORDON J. HUMPHREY, A U.S. SENATOR FROM THE STATE OF NEW HAMPSHIRE

Senator HUMPHREY. Thank you, Mr. Chairman. I find this a very interesting topic from a number of points of view, economics, foreign relations, theories of proper bounds of government and, last but not least, my own personal interest in computers. I like to think and truly believe that I have the most computerized office here in the Senate. My staff know better than to ever call me on the telephone. All communications are electronic except in the direst emergency and we have not had any of those.

Back at home, I will not say the brand, but a personal computer vintage 1979 or 1980, I guess, which makes it an antique by today's standards, but I have kept it souped up with the addition of a number of boards over the years and so I can really get into this stuff.

I am not sure from which angle to proceed here, really. I have some mixed feelings about this whole business. Let me ask you for a little history here, if I may, Mr. Augustine. How did it come that the United States first was preeminent in the design and manufacture of chips and now finds itself endangered?

Mr. AUGUSTINE. I believe we went through a series of phases. As has been pointed out by my colleagues on the panel, the early phases were ones where the transistor was invented by an American, as you well know. The integrated circuit was invented in this country. Most of the innovations in how to build them were invented in this country. So we had a clear lead and it reflected itself in the market shares around the world.

I believe the first thing that happened to undo that or to unravel it was the difference in wage rates between the U.S. labor force and overseas force. In order to be competitive, U.S. firms began to move capabilities overseas, which in the long term I think hurt us. That is a personal opinion.

Today, the wage factor is much less important. We are so highly automated that there is very little labor content in chips today. I think the next phase was one where interest costs were higher to U.S. manufacturers. There was a substantial disparity between the buying power of the dollar and the yen and that served to hurt U.S. manufacturers. At least at the moment, that also appears no longer a driving factor.

Again, from the standpoint of the Defense Science Board, I think we went through a period where the U.S. industry, including the semiconductor industry but not exclusively the semiconductor industry, did not pay attention to the importance of quality and productivity to the extent that the Japanese did. We have paid and we are paying a price for that. I think the Japanese would probably

say the reason they believe we do not have large market share around the world is a difference in quality.

I suspect that was probably true at one point. I think it is less true, if it is true at all, today, but that was a factor along the road. So I think we went through a series of circumstances. We went from market domination to the situation today, when these factors have had their impact and we are just hanging on in many respects.

Senator HUMPHREY. You suggest that the decline in quality has been arrested, did I get that correctly?

Mr. AUGUSTINE. The other gentlemen at the table build devices and I do not, so they could probably answer that better than I. Obviously, it is very difficult to get good data on this subject, and you are dealing with some very competitive issues. But the studies we did convinced me that 5 or 7 years ago we were clearly behind in this country. Today, I think it depends on what particular devices you are talking about. I believe in some cases we are ahead and in some we are behind, but I would defer to my colleagues on the subject.

Senator HUMPHREY. Okay. Before I move on, you are quoted by Hobart Rowan, in a column that I am sure you have seen, which was published in some newspaper recently—have you seen the column?

Senator LEAHY. About 10 days ago.

Mr. AUGUSTINE. I have seen a lot of them recently.

Senator HUMPHREY. The Defense Science Board report—I will just read what it says here: "The Defense Science Board, headed by Martin Marietta Corp. President Norman R. Augustine, concluded that the quality of American chip technology is 'steadily deteriorating' relative to the Japanese."

Mr. AUGUSTINE. I suspect the word "quality" there probably was used in the broader term, meaning the overall quality of our technical capability, rather than quality in terms of chip defects per million units or something like that.

Senator HUMPHREY. You were chosen to head this board because of your involvement in the defense industry, is that correct?

Mr. AUGUSTINE. Frankly, I am not sure why, but I think it was because I really do not have a conflict of interest. I am not in the business. I have worked on the Defense Science Board for many years and as it happens—and this is incidental, I believe—the company I work for cannot deliver its products without semiconductors. Now, we can clearly deliver second-rate products with second-rate semiconductors, but personally I would like not to do that.

Senator HUMPHREY. Then, as an objective observer, do you have an observation to make about the—we have heard a lot about the external, the overseas causes of our problems, what about the internal, domestic causes, can our industry be accused of shortsightedness in failing to devote sufficient portions of our revenues to R&D and perhaps too much to dividends, for example?

Mr. AUGUSTINE. I have thought about that a good deal. If I were to fault the industry, I think we could fault our country, too, as a whole for some of the factors that have made it difficult for the industry.

In terms of the industry itself, I think it should have paid more attention to quality during the earlier years. I believe it is doing better today. Clearly, the industry should have paid more attention to manufacturing technology. We got lost in the area of innovation and the Japanese stole the march in the area of manufacturing technology. I think that the industry realizes that.

In other areas, one often hears the industry has not invested in R&D to an adequate degree, it has not invested in capital to an adequate degree. I personally do not think the facts support those assertions. Certainly, by Japanese standards, they have not invested in capital and R&D to the extent that the Japanese have been able to do so. But, compared with other U.S. industries the semiconductor industry has invested a larger percentage of sales and a larger percentage of profit in both capital and R&D than most of our industries. That includes my own.

Senator HUMPHREY. Let me play the devil's advocate. Is that not in large measure attributable to the special nature of this industry? I would imagine—and I am hardly an expert, I am just an end user who does not know as much as he thinks he does, probably—is there not a special nature to this industry to manufacture chips? I mean it does not require nearly the space, the capital expenditures that the building of defense systems does, am I correct?

Mr. AUGUSTINE. Specifically in terms of the required space you are. We build the Titan missile and the external fuel tank for the space shuttle, for example, and those take a lot of space and a lot of buildings. But in terms of basic capital, the semiconductor industry is faced with a circumstance where it has had a whole new generation of products on the average of every two and a half years for the last 20 years. All the factories you had for one generation by and large are not even applicable to the next generation. So you have to build a whole new plant every two and a half years on the average. Worse yet, the cost of those plants has increased with each generation. Today, to build a plant for the next set of chips is about $150 million just to build the first chip in high-rate production.

Your question points to the problem faced by small U.S. firms, with limited capital, limited borrowing power, and a certain degree of shortsightedness is forced upon them by the U.S. marketplace. Under these conditions, the trouble U.S. companies have competing with a combine of Japanese industry, the Japanese government, and Japanese academic institutions, which have great staying power, is the root cause of today's problem.

Senator HUMPHREY. Let me move on to Mr. Noyce. The suggestion here seems to be that the only way we can deal with the combine, as Mr. Augustine puts it, is to create our own. Is there not an alternative to that? Is there another simpler way of doing this, more consistent with our free enterprise traditions?

Mr. NOYCE. I think that if we were not faced with competitors that were playing by a different set of rules, we would do fine, but there is still an argument I think in favor of creating the public good that is done through research and development.

The problem in all research is that left to private decisions, it will always be under-funded from the optimum level because of the fact that much of the research results are inappropriable and go

into the general public pool of goods, rather than accruing benefit to the sponsor. That has been recognized in particular by Japan as they have been trying to create their own competitive advantage based on knowledge, rather than raw materials of which they have none, and they have recognized that perhaps earlier than we have when we have been talking about comparative advantage due to forests or farms or mineral resources.

It is more and more important, as this world economy develops, for America to recognize that its basic goods are in the minds of its people and that that requires not only the investment in plant but it requires the investment in the infrastructure of an advanced industrial economy, a great deal of which is creating this public good of knowledge. I think that it is fully justifiable for the public to support that end.

Senator HUMPHREY. The difficulty is once you do it for one industry, there is no end to the demands and rationalizing to do it for other industries, all industries.

Mr. NOYCE. We have done——

Senator HUMPHREY. Everyone has his own angle, our industry is unique, our industry is leveraged, our industry is critical to national defense.

Mr. NOYCE. Historically, we have done it for agriculture. It was started at the time when half of our population was on the farm. Today, the electronics industry is America's largest industry, equal to the sum of steel and autos, for instance. And I think to get back to the basis for that largest industry in America, you can make a case that will be justifiable in that case and indeed I would support the same kinds of proposals for other American industries to build the American economy.

Senator HUMPHREY. You do not doubt, then, that this would be the beginning of a trend, not an isolated case, not an exception, but ultimately this approach would be the rule in American industry?

Mr. NOYCE. America has long done this. It started with the land grant colleges. I do not think it is a change. It is a change, recognizing the change in the industrial makeup of America only.

Senator HUMPHREY. I am not sure I agree with you.

Mr. NOYCE. I would like to comment on a couple of the other questions that you asked Mr. Augustine, if I might. The semiconductor industry has spent a higher percentage of its revenues on R&D than any other domestic industry, four times the industrial average.

The capital intensity of the industry surpasses almost any that you can imagine now, with capital investments averaging 20 percent of sales per annum. So it is not a low capital industry.

Indeed, though the direct labor content is small, because the amount of direct labor is relatively small, the total labor content, the total percentage of our costs, including the design, development, including the president and the accountants and the lawyers, is 40 percent of the total. A much higher labor input, if you consider those skills labor, than the average industry, consequently differential costs of engineers in Korea or Japan are very important and they are cheaper there still.

Senator LEAHY. Could I just interject on that, about the 20 percent? I might say I wish some of our heavy manufacturing had

done the same thing over the years, we would be in better shape than we are today. But how does that 20 percent compare with the Japanese or the Koreans?

Mr. NOYCE. The Japanese have in recent years invested about 30 percent, mostly in building new capacity, rather than replacing old capacity, and that is one of the primary causes of today's problems in the industry, where there is gross over-capacity and the consequent dumping that is a natural outfall of the over-capacity, or at least it is natural for the Japanese, let me put it that way.

Senator HUMPHREY. Thank you, Mr. Noyce.

Let me move on to Mr. Cornell. It is represented that the semiconductor industry in the United States has adequately invested in R&D and capital. Am I correct in that?

Mr. CORNELL. Certainly in the area of R&D, yes.

Senator HUMPHREY. Well, just where do we stand in the—how modern is our plant and equipment? I have heard that the stuff is pretty old-fashioned.

Mr. CORNELL. We need to distinguish between the types of R&D investment, because that is part of the problem. The strategy that U.S. producers of semiconductors had is to invest heavily in product related R&D and invent new process technology and new products, and we have indeed led the world in that.

On the other hand, we have under-emphasized the R&D associated with manufacturing technology. Now, initially, perhaps of necessity, because if you do not have any products you do not need a factory, the second half of this issue is that Japan has in effect gotten a free ride in the sense that the Japanese strategy has been largely to, in plain English, pirate our product technology and hence get that for free or essentially free. As a consequence, with a comparable R&D investment, they have focused that R&D on manufacturing technology and as a consequence—and I do not let us off free on that, we have erred strategically in our failure to recognize the significance of manufacturing technology, nonetheless, though, that this free ride which we have addressed recently, and we are still concerned with, about the protection of intellectual property, is one of the continuing issues that we have not dwelled on too much here, is that we need to be able to protect our invention in the form of our products.

Nonetheless, Japan has been able to focus their resources in the manufacturing technology and through so doing establish a competitive advantage in manufacturing, so in a sense we have indeed invested properly in product technology but, yes, indeed, we have fallen behind in the quality and the capability, if you will, of our factories, and so a lot of what we are speaking to in the Sematech initiative and the things that Mr. Augustine and Dr. Noyce referred to is to shift our emphasis into manufacturing. Clearly, we cannot abandon product technology.

One of the reasons we are going to require some support financially in doing this is we still have to maintain leadership in product technology, but to focus in manufacturing is essential.

Senator HUMPHREY. Well, this proposal would infuse $450 million, am I right in that? That is what is quoted in the Rowan column.

Senator LEAHY. That is one of the things we are still trying to pin down.

Senator HUMPHREY. Would it not be easier—I mean if we have to go this way, if it is decided to go this way, would it not be easier just to give this particular industry a special tax break? It would not have to be the same amount. You could probably do it a lot cheaper, just make it a direct subsidy, rather than an indirect subsidy. Would that not be better and simpler?

Mr. CORNELL. Well, I am not really in a position to comment on that, but let me say this, that clearly Mr. Augustine referred to the rough estimate that his group has made on what it would cost to do this. The semiconductor industry in this country, and particularly the Semiconductor Industry Association, have studied the problem in somewhat more detail and have done certainly not a line-item thing but we have done some little finer estimate, and indeed the range of a few hundred million dollars a year to operate this activity is about right.

The point is that we basically do not have $200 million a year and our view is that we should certainly support it to the extent which we can. We are going to need support from the government to do this. We believe that is in the best interests of the Department of Defense to see that this happens, hence to have them involved and perhaps try to channel the funding in that way could be appropriate.

Some of the funding, I should point out, would not go to Sematech. We feel that initiatives in the national laboratories of the U.S. government, further support in manufacturing to the university environment are all worthwhile things. In fact, these very same things were pointed out in the Defense Science Board recommendation.

Frankly, our concern is really not so much with the exact mechanism of funding but with the fact that about this amount of money is necessary and we need to get on with it right now. Timing is extremely critical and it needs to be initiated immediately.

Senator HUMPHREY. A quick question, with a quick answer: Can we ever get back to the high-volume market?

Mr. CORNELL. Yes.

Mr. AUGUSTINE. Yes.

Senator HUMPHREY. I would like to pursue that, but I can see the Chairman wants to resume being Chairman.

Senator LEAHY. No, no. Your questions are good ones and I am not a stickler on the time. I think they are worth pursuing.

Mr. CORNELL. I would like to emphasize one thing in one regard. This is certainly a risky situation. I mean it is not obvious that we can do it as quickly as my quick answer would say. It falls into the category of what I would describe as given two alternatives, one is acceptable, forget it, and the one alternative that is unacceptable is to do nothing because we will surely fail.

The other alternative which we believe to be this one, we see no other one, is the one that we must and will follow, is to pursue this approach, but we believe it can happen.

Senator LEAHY. My intent was not simply to convey a feeling of gloom and doom here. But I must admit that one of the reasons I wanted to hold these hearings was to emphasize and to bring out

much of what has been discussed today and last week—how crucial the situation is, how serious it is and the fact that we cannot just expect the situation to work itself out. I agree with the opinon that doing nothing is the worst possible reaction.

Mr. Augustine, the report states that the Soviet Union is about five years behind the U.S. in the production of integrated circuits. It also states that a generation of chips last about two and a half years. Does that mean that the Soviet Union is even more dependent on foreign nations for the state of the art chips than the United States is?

Mr. AUGUSTINE. I think that the Soviet Union, by its very nature, tries to be very independent and prefers not to depend on other countries for chips. I think that accounts to some degree for why they are so far behind. And if there is any good news in this whole story from a defense standpoint, it is that the Soviet Union is probably much further behind us than we are behind Japan.

Senator LEAHY. It is not a case where the Soviet Union is getting ahead of us. In effect, the Soviet Union is getting further behind, but it is a case where we are becoming more reliant on our allies?

Mr. AUGUSTINE. I think that is true and I think you would have to add that the Soviet Union is showing signs of trying to obtain chips from other parts of the world now, trying much more aggressively to do that. Basically, they have sought the technology as opposed to a production supply of chips, and that I think could introduce a new factor in the equation.

Also, I would have to observe that the Soviet Union has really never adopted a strategy of having superior technological equipment for their military. They have counted on having good equipment and lots and lots of it. We have some 12,000 tanks and they have 45,000 tanks, and so on down the line. They, unlike ourselves, have not counted on technology to give them the edge. Fortunately, in this area, they do not have it and that is the bright spot in this whole story.

Senator LEAHY. Did you consider the Soviets' position vis-a-vis our position when you made your recommendations?

Mr. AUGUSTINE. Yes.

Senator LEAHY. Well, we are becoming more reliant on our allies for integrated circuits?

Mr. AUGUSTINE. Oh, no question about it, not only for the chips themselves but for the technology.

Senator LEAHY. I want to make sure I fully understand that. It is the tradition of the Soviet Union that they will not become dependent on other countries, they will try to provide for themselves?

Mr. AUGUSTINE. They have always tried to maintain their own production sources and to buy or steal the technology as best they can. I think that is generally true today. But if they get far enough behind I think they are going to be faced with the problem of having to get their production sources from abroad if they can.

Senator LEAHY. They have not been reluctant to pick up technology, technology from other countries, any time they could, however.

Mr. AUGUSTINE. They have been better than we at that.

Senator LEAHY. You do not think their consulate in San Francisco is there simply to process visas or to enjoy the view as the fog rolls in across the bay? [Laughter.]

Mr. AUGUSTINE. That is beyond my field to judge.

Senator LEAHY. I only know what I read in the papers. They give you the best source of intelligence gathering. [Laughter.]

Dr. Noyce, you are sort of a hero in the semiconductor industry, and I do not mean to embarrass you by raising that, but they tell me you identified the problem, you solved it, and the chip was born. People were then able to take those chips in small-scale and large-scale and everything else, working whether in a company or the basement or wherever else, and developed a lot of machines that certainly have revolutionized the world.

I am 46 years old and I think of some of the enormous changes that have taken place just in my lifetime, and all of that came out of what we really see as free enterprise, whether it was a small company in Silicon Valley becomes a giant, or whether it is some of the major industries that became even more so, so throughout that you watched a lot of very innovative people build on the development of each other. Now, how do you feel now about the government stepping in? That really comes back to Sematech. Is it a natural evolution? Is it a different ball game? Have we gone as far as we can in the free enterprise system?

Mr. NOYCE. I suppose that if I had been totally reliant on the free enterprise system, I would not be here because I went to MIT, working for the Research Lab for Electronics up there, which was totally supported by the Defense Department, so I owe my Ph.D. to the Defense Department.

Now, there is a form of subsidy perhaps to the industry and indeed it is one of the forms of subsidies that we have been trying to give to the university through the Semiconductor Research Corporation. But I think that what is essential here, as I said earlier, is to create, to restock the stream from which we are all fishing, that if we do not keep that pool of knowledge from which we can all draw filled up, that we will finally die of thirst.

Now, the question is what is the most efficient way within our nation to do that? There has been a long tradition of doing research for the nation on the nation's pocketbook, rather than relying totally on private interests to do that. I think that is a good idea.

I am not willing to give up the free enterprise system. It has treated me very well and I think it has treated all of us very well, all Americans. But what we are faced with now is a system which has been pioneered by the Japanese of creating their own competitive advantage by being better at some of these things than we are, in other words by seeing that there was utility in creating comparative advantage through knowledge. I think that part we should emulate.

Senator LEAHY. So you really see government stepping in to fill a particular void, but not to supplant.

Mr. NOYCE. By no means to supplant the individual initiative in seeking opportunities and exploiting them but, rather, by making the tools available to the entrepreneur so that he can do so.

Senator LEAHY. Sematech will be controversial, I suppose, and, you know, it is still hard for us to focus on just exactly what is wanted.

Mr. NOYCE. We are still working it out.

Senator LEAHY. Those of you who deal with it all the time and work with it all the time are having some difficulty in joining together in just what the model should be. You can imagine the difficulty that there is going to be here on the Hill. We have a whole lot of other subjects that we have to focus on and on that one none of us have any kind of expertise but you do.

Let us suppose that in focusing on this for a few years—and I ask this question of all three of you—can we take two or three years?

Mr. NOYCE. We have farther to come back if we wait. The industry in this case is not standing still. We will have a harder race to run if we let them get further ahead of us. I think that American ingenuity and so forth can do anything it pleases if we can get ourselves behind the idea of doing something, whether it is to go to the Moon or to compete in semiconductors.

So I am not going to write off the industry until after my death, but rather keep fighting to reestablish our preeminence in this field.

Senator LEAHY. When we were putting together some of the Mathias-Leahy chips legislation several years ago, I know it helped us greatly when we could get the industry to coalesce both on the problem and a solution. Again, because none of us had the expertise in dealing with something where you are really making a huge leap into the future.

It is one thing when we know the day-to-day needs, what should a nutrition program do, how many housing units might be needed, even some year by year weapons system for the defense of the United States. But what we are really doing in this case is making some decisions that may determine just where we stand in the next century. We will be determining our national security and the economic wealth of this Nation. We will be determining whether we are a second-rate condemned to always playing catch-up in an industry which clearly does not allow for second place.

Mr. CORNELL. Mr. Chairman, I heard your question, which I hope was rhetorical.

Senator LEAHY. I want to emphasize that I do not want to wait several years for the answer to this question, otherwise we would not be having these hearings this afternoon.

Mr. CORNELL. I presumed that was the case. My observation on that question would be, first, we cannot wait three years. We, on what I hope is a very unlikely situation, we as the U.S. industry would have no option but to proceed and do the very best that we could.

The issue here is the magnitude of the problem and it has been building for fifteen years and perhaps we have something on the order of 5 years to get back into some position of parity and hopefully go ahead. We have to start now, and it is risky at best, and certainly without the involvement and the cooperation and support of the government it becomes even more risky and the principles that I think Dr. Noyce and Mr. Augustine have outlined regarding the vital role semiconductors play, it would seem to me very appro-

priate, considering the importance and considering the risk of what we are doing, to get to the highest possible form of government support as soon as possible.

Senator LEAHY. Mr. Augustine, do you feel the same way?

Mr. AUGUSTINE. Yes, I do. Mr. Chairman. I mentioned that I have never been involved with a subject that I viewed as being more important either to defense or the national economy. I truly do feel that way.

I feel we may be at a turning point in history. I know that concept is often misused and overstated, but there is a possibility that we might look back upon this particular couple of years, this "window," and say that.

Clearly, given enough money and enough time, one can catch up in almost any area. But the longer we wait, the harder it will be. I would say we have no more than a year or two. After that, if we have not taken effective action, I think we will start to slide back very quickly.

Senator LEAHY. Well, during the past year especially, I think my children probably got tired of me saying that my children are going to live most of their lives in the next century. So much so that I once introduced them, and they all piped up and said we are going to live most of our lives in the next century. [Laughter.]

But, really, we are determining and making some determinations that are going to affect the next century. They will affect how all of them are going to live. I agree with you that it is a very, very important issue.

I appreciate you taking the time. I am going to keep the record open so that other Senators can submit questions. I will have some of a more technical nature. I would urge all of you who are working within the industry, if you want to bring just one message back from me, it is that to the extent that you can be unified in your own proposals.

None of us up here expect perfection and nobody up here expects that you can totally predict the future 5 years, 10 years, 20 years away. But to the extent that you can use your best judgment, reconcile differences yourselves in the proposals you make to us. If you can do that, the better we are all going to be, because it is an area where both government and industry are going to have to cooperate for the good of all of us.

[The following questions and answers were subsequently supplied for the record:]

ANSWERS TO WRITTEN QUESTIONS

Question. Dr. Noyce, the March 5, 1987 *Washington Post* reported that the semiconductor industry has decided to establish "Sematech" as a research and development company more geared to the development of the specialized, low volume circuits. Does that decision mean that U.S. computer companies are abandoning any idea of regaining leadership of the high volume D-RAM market?

Answer. It is important to remember that the Sematech project is still in the development stage—many of the details have yet to be worked out. However, the decision to use a small scale prototype facility to proof test new manufacturing technologies does not necessarily preclude a return to competitiveness in DRAMs.

Question. Mr. Cornell, it appears that the semiconductor industry has decided to use "Sematech" as a consortium oriented more toward the refinement of technology than the manufacturing of specific products. How will the consortium prove the effi-

cacy of any manufacturing processes that it develops if it does not have a high volume production line?

Answer. The consortium is exploring techniques for transferring new manufacturing systems to one (or more) member companies to perform high volume proof tests in its commercial line and to feed back the performance results to Sematech.

Question. Mr. Cornell, What will be the criteria for membership in the consortium?

Answer. U.S. equity ownership and substantial manufacturing in the U.S.

Question. How will the consortium insure that the technologies developed by the consortium are distributed equally among all the members of the consortium? Would the consortium permit the technologies developed by the consortium to be distributed to foreign manufacturers?

Answer. All members of the consortium will have access to the new manufacturing and process technologies in the developmental state and when released after extensive production proofing. No, Sematech does not currently plan to directly license foreign companies the process technology.

Question. Mr. Cornell, the "Sematech" consortium will need financial support from the federal governments. Could the consortium be re-oriented toward the manufacturing of specific products, as opposed to the refinement of technologies if the government entity providing the funding so desired?

Answer. The primary objective of the Sematech project must be the development of advanced manufacturing processes and equipment and actual measurement of their performance in a production environment. It is possible that a flexible manufacturing line may be established to manufacture special products such as those required by the U.S. Government on a non-interference basis.

Question. Mr. Cornell, who would have the proprietary rights to the intellectual property—the patents, copyrights and trade secrets—that are developed by a manufacturer consortium that receives a great deal of funding from a federal entity? Do you agree with Deputy Under Secretary of Defense Kerber who told the subcommittee that the Department of Defense would have those rights?

Answer. The rights will be shared by the members of the consortium. The Department of Defense would not hold exclusive rights.

Question. Mr. Noyce, If the U.S. is falling behind in semiconductor manufacturing capability, but not in innovation and product development, won't we still be able to meet our defense needs through licensing agreements?

Answer. No. History demonstrates that innovative products licensed to Japan will be imitated and refined and produced first and foremost to meet the requirements of the Japanese industry. The U.S. would slide into a foreign dependency status inimical to our national interests. The answer to our national security needs is an aggressive, competitive semiconductor industry.

Question. Will the Pentagon's needs be met if U.S. companies form links with their Japanese counterparts? For example, would more agreements like the one recently announced by Motorola and Toshiba help solve the Pentagon's problems? Would such agreements solve the industry's problems?

Answer. The Motorola-Toshiba agreement gives Motorola apparent access to the Japanese market—a short term tactical advantage in older technologies. But Motorola is also a prospective participant in Sematech and will therefore benefit from the preeminent technologies to flow to U.S. member companies from that consortium in the long term, 1990–1995.

Question. Mr. Noyce mentioned in his testimony that the U.S. is one of the few technologically advanced nations which has not organized a government program for the development of semiconductor technology for commercial application.

Has anyone conducted a study of the implementation of the programs adopted in other countries? Are any of the proponents of a U.S. manufacturing consortium studying the programs of other advanced nations to see what we can learn?

Answer. Yes, we have studied the developmental strategies of Japan, Western Europe and South Korea in depth, have documented the information and would be pleased to provide you with a copy on request.

Question. I would be curious to see an analysis outlining the aspects of those programs that we might want to follow and those aspects which we might want to avoid.

Answer. The aspects we might emulate would include procompetitive industry-government cooperation in stimulating advanced research. The aspects we would avoid would be (a) limiting access to special incentives and cooperative programs to an elite group of preferred companies and (b) closing the domestic market to foreign companies so that the preferred domestic companies have a "private preserve" to sell which was intergral to Japan's plan.

Senator LEAHY. I thank all of you for taking the time here today.

[Whereupon, at 4:40 p.m., the subcommittee was adjourned.]

APPENDIX

McDERMOTT, WILL & EMERY
A PARTNERSHIP INCLUDING PROFESSIONAL CORPORATIONS

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February 26, 1987

ROBERT S. SCHWARTZ
202/778-8081

Hon. Patrick Leahy
Chairman, Subcommittee on
Technology and the Law
Committee on the Judiciary
United States Senate
Washington, D.C.

Re: Semiconductor Chip Protection Act of 1984

Dear Senator Leahy:

On behalf of the Electronic Industries Association of Japan ("EIAJ") I would like to thank you for the opportunity to participate, by submitting this letter for the record, in this first hearing of the Subcommittee on Technology and the Law. This is an important subcommittee and today it examines an important subject. Personally, and on behalf of EIAJ, I want to offer best wishes for the future and pledge our full support for and cooperation with this subcommittee.

The international provisions of the Semiconductor Chip Protection Act of 1984 ("SCPA"), which could have been a cause for international contention, have instead been a model of reason, cooperation and civility. For this we have yourself and Senator Mathias, and Rep. Kastenmeier, to thank. By forging Section 914, in a way that could be supported by both domestic and overseas interests, the Congress helped insure that the SCPA would enhance, rather than detract from, the protection of intellectual property world-wide.

The EIAJ takes great pride in first having suggested the need for Section 914. On July 18, 1984, Mr. Akio Morita, Chairman of Sony Corp. and (then) President of EIAJ, wrote to Sen. Mathias and Rep. Kastenmeier. On behalf of EIAJ, he stated support for the enactment of the SCPA. He added:

> Since the U.S. legislation will be the first of its kind in the world, we hope that it will meet the challenge posed by the development of a new class of intellectual property by affording it a commensurately new form of protection. We expect that this approach by the U.S. will serve as a model for other countries. In this repect we feel it would be very beneficial for such legislation to maintain an incentive for forcign nations to "catch up", without departing from the principle of full national treatment. This could be accomplished by a reasonable interim period for full-term registration, not limited by considerations of nationality, domicile, or place of first commercial exploitation.

Mr. Morita's request was coupled with on offer. EIAJ had been informed that the Congress would be more receptive to interim protection if it knew that overseas manufacturers and governments of major semiconductor manufacturing nations were also interested in immediate protection for layouts, and would follow the U.S. lead with their own legislation. Mr. Morita said:

> In this connection, we have been asked whether EIAJ has a view as to probable or appropriate legislative action in Japan. Speaking on behalf of the semiconductor manufacturers of Japan, EIAJ recognizes the need for, and importance of, protection in Japan for the intellectual property embodied in semiconductor chips. Accordingly, we will ask the Government of Japan to provide such protection, as expeditiously as possible, through a new legislative framework.

Within one year of the date of this letter, Japan enacted its own law giving sui generis protection to mask works, on substantially the same basis as the SCPA. Moreover, Japan's Act makes no distinction whatsoever as to nationality or domicile of the registrant. It is now generally accepted that Japan's Act is in substance not just similar, but the same as ours, and is still the first and only one in the world that is. Rather than digress to illustrate this, I have appended a copy of EIAJ's most recent presentation to the PTO on the subject of Japan's Act, including a booklet published in English by Japan's registration organ, the Industrial Property Cooperation Center ("IPCC") that explains the Act's text, regulations and operation. The EIAJ presentation included a Declaration by the President of the IPCC as to the impartial administration of the registration function. (Impartiality of the IPCC itself is guaranteed by the Act. See Art. 30 (3) & (4), and the Declaration of Mr. Toi filed with the PTO.) I ask that this material, a current letter from the IPCC, and a copy of Mr. Morita's original letter be received into the record along with this letter.

The impartial administration of Japan's Act, once a matter that needed to be explained, is now a matter of record. Japan has been issuing registrations now for about 14 months, since January of 1986. The record as of Feb. 21, 1987 is as follows:

Total applications subject to final action:	871
Registrations issued:	871
Applications from foreign entities:	100
Registrations issued to foreign entities:	100

On July 9, 1986, I had the pleasure of appearing before the PTO and discussing IPCC statistics as of that date. The distinguished representative of the Semiconductor Industry Association suggested that further experience was necessary. Now, that there have been 100 foreign applications in Japan without a single rejection, I suggest that the impartiality of administration of Japan's act, as well as its substantial similarity to ours, should be taken as established. Accordingly, although we are pleased to offer our comments as to possible amendments to the SCPA, we do not believe that any such possible amendment would require or justify a delay in issuance of a Presidential Proclamation for Japan.

Modifications to Section 902

Having studied the Feb. 3 Congressional Record (pp. S 1613 - 1614) we are pleased to comment on your suggestion about "opening up" the Section 902 process before PTO takes the step of recommending a Presidential Proclamation. If Section 902 is to be modified so as to set forth requirements, as Section 914 does, the questions are: what findings must be made, and what conditions should be attached?

Necessary Findings

Section 914 requires the applicant to demonstrate, or the PTO to otherwise find, three basic things: (1) good faith progress toward enactment of a law; (2) lack of misappropriation by nationals; and (3) issuing an order would promote the purposes of the Act and international comity. Are these appropriate tests for a Section 902 Proclamation, as well?

Good faith progress. This point should be moot in the case of Section 902. Is there some other test that should be substituted, such as a one year minimum period for the law to have been in operation? So long as interim protection under Section 914 is still available, this would not seem unreasonable. It does not address the thorniest questions, however, arising from interpretation of existing foreign law.

Inevitably, any "test" of a law for purposes of Section 902 must be more qualitative than quantitative. The issues of substantial similarity and national treatment can be preliminarily determined in an applicant's favor under Section 914 -- but this postpones the tough judgments until the Section 902 proceeding. The Congress should decide, therefore, whether it wishes to impose substantive standards on the PTO for deciding what complies with 902(a)(1)(B)(2)(A) and/or (B), whether it should require PTO to establish procedures for deciding this, or whether it should leave this question to the discretion of the PTO. Since Japan's law is not just similar, but substantially the same as the SCPA (we have called it a "reverse engineered" version), EIAJ doe not take a position on this question. We do urge, however, that the clear and unique case of Japan not be postponed while this general question is being addressed. The record on behalf of a Proclamation for Japan is established and does not require any qualitative judgments.

Lack of misappropriation by nationals. It might be argued that this point is moot as to Section 902 because any nation with a law in force should not be expected to experience any misappropriation. The original purpose of Section 914 in this respect, however, was broader. It penalizes a nation for misappropriation by its nationals no matter where it occurs, and even if the "misappropriated" work would not have been protectible under the SCPA itself.

At the time of the Act's passage, this "misappropriation" provision in Section 914 was seen by some observers as a way of resolving issues over the extent to which the Act would have retroactive coverage, without formally expanding the retroactive provisions of the Act. This retroactivity concern now seems moot. However, there might still be some interest in the extraterritorial effects of this provision -- penalizing a nation for acts of misappropriation by its nationals, even though they occurred in third countries.

EIAJ believes this extraterritorial reach, while it might be appropriate under Section 914, is not warranted under Section 902. The blanket, national penalty for acts of misappropriation is itself rather harsh. Company A might be the victim of an act of misappropriation, in a third country, by Company B, which happens to share the same domicile. Should Company A be further victimized by failing to be able to

register its works in the U.S., so they can be misappropriated here, as well? In view of the diminished need (in terms of retroactivity) for this provision, we believe it would detract from the constructive purposes of the Act to add the no-misappropriation-by-nationals requirement to Section 902. The records made to justify continuation of status under Section 914 should be sufficient. In any event, insofar as Japan is concerned, in two and one-half years before the PTO, there has been no allegation whatsoever of misappropriation by any Japanese national or domiciliary.

Promote International Comity and Purposes of Act. We don't have any comment as to whether the Congress ought to attempt to spell out the meaning of this discretionary provision for the President and the PTO. We do believe very strongly, however, that whoever makes this judgment should recognize that an important purpose of the Act was to promote the adoption of other sui generis chip mask laws internationally, and that those nations who have complied ought to have discretion exercised in their favor. In the case of Japan, the early letters from Mr. Morita and the prior agreements involving the High Technology Working Group forged a covenant, which has been kept. The swift manner in which Japan's industry and government performed ought to be met with expeditious action in return.

Conditions

Section 914 grants protection on a conditional basis only. Although registrations themselves are not destructable, the right to register may be revoked upon a finding that the prerequisite conditions no longer exist. Should status under Section 902 be similarly destructible?

Status of law. If a nation should repeal or fundamentally modify its law that was the basis of a Proclamation, this could justify revocation. Where the legal protection is granted by a new and specific statute, this seems unlikely, unless the scheme were to be struck down by a court. It seems more likely where the requisite scope of protection rests on a legal interpretation that is later overturned.

In our view, the basic intention behind a Presidential Proclamation under Section 902, even as it is presently written, is that the President's judgment can only be based on the foreign law insofar as it can best be interpreted and understood. If the interpretation and/or understanding should change dramatically, the original basis for the Proclamation would no longer exist, and it could be withdrawn. Whether the revocability of Proclamations in this respect ought to be spelled out by the statute is a matter on which we offer no opinion. EIAJ would be content for any proclamation issued for Japan under the existing Section 902 to contain language that it may be withdrawn in the event Japan's Act is amended or struck down in a way that would have been considered material at the time the Proclamation was issued.

Misappropriation. Inasmuch as we believe this factor should not be considered in the issuance of Presidential Proclamations, it ought not be a basis for withdrawal of one. Indeed, even if misappropriation should be considered as to issuance, it should not be a factor in destructability. Consider the case discussed above, of law-abiding company A losing its right to protection from pirate B in the U.S. because pirate B engages in misappropriation in a third country. Now, suppose Company A is a long-term cross-licensee of U.S. company X, which is entitled to a license under company A's new works. Pirate B, by being able to jeopardize the registration status of a whole nation, becomes a threat to U.S. company X as well, because Company X has paid for rights that company A, by no fault of its own, might not be able to deliver.

In our view, the rightful goal of the SCPA was to establish (until a treaty can be agreed upon) a web of national laws of protection and integrity, so as to promote a positive and predictable climate for investment in new technology. Going beyond this goal, to police activity not covered by the SCPA or the new web of national laws, threatens to become counter-productive, as it may detract from, rather than add to, the security of conditions for investment.

International Comity and Purpose of Act. In our view, this factor is too discretionary to be reviewed after the initial determination to issue a Presidential Proclamation. If the "layout right" is to become a stable basis of technological society, along with patent, trademark, and copyright, it should not be destructible according to factors that are essentially discretionary.

Extension of Section 914 Through November 7, 1990

EIAJ supports S. 442 without qualification. As the first applicant, and a participant in every PTO proceeding under this Section, EIAJ believes that the Section 914 process has been both constructive and fairly administered.

As we have indicated above, we hope and trust that, in the case of Japan, none of the extended period of time will be necessary. Indeed, the fact that a three year extension of authority under Section 914 is otherwise so clearly appropriate, whereas Japan's law has been "on the books" for nearly a year and a half, indicates that a unique accomplishment ought to receive unique recognition.

Please let us know if there is any further information we can supply on behalf of EIAJ, or if there is any other way we can be of assistance to the subcommittee.

Respectfully submitted,

Robert S. Schwartz

RSS/jd

encl.

ELECTRONIC INDUSTRIES ASSOCIATION OF J...
TOKYO CHAMBER OF COMMERCE & INDUSTRY BUILDING
3-2-2, MARUNOUCHI CHIYODA-KU TOKYO
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CABLE ADDRESS
EIAJAPAN TOKYO
TELEPHONE [illegible]

July 18, 1984

Hon. Charles McC. Mathias
Chairman
Subcommittee on Patents,
Copyrights and Trademarks
Judiciary Committee
U.S. Senate
Washington, D.C. 20510
U.S.A.

Dear Sen. Mathias:

I was sorry to have missed the opportunity to see you during my recent trip to Washington. I do hope, however, that we will have another chance before too long. In the meantime, I did want to call to your attention something that is of great interest in my capacity as President of the Electronic Industries Association of Japan (EIAJ).

EIAJ has been following the progress, through the Congress, of legislation that would afford a new form of protection for semiconductor chip products. In our view, the passage of such legislation is highly desirable, both of itself and as an indication of the proper direction for the international protection of such intellectual property. In this latter respect, we note the joint recommendations of the U.S.-Japan Work Group on High Technology Industries, made in November, 1983. One such recommendation of this government-to-government group was:

III. Technology

3. Both governments should recognize that some form of protection to semiconductor producers for their intellectual property is desirable to provide the necessary incentives for them to develop new semiconductor products. And both governments should take their own appropriate steps to discourage the unfair copying of semiconductor products and the manufacturing and distribution of the unfairly copied semiconductor products.

Since the U.S. legislation will be the first of its kind in the world, we hope that it will meet the challenge posed by the development of a new class of intellectual property by

affording it a commensurately new form of protection. We expect that this approach by the U.S. will serve as a model for other countries. In this respect we feel it would be very beneficial for such legislation to maintain an incentive for foreign nations to "catch up", without departing from the principle of full national treatment. This could be accomlished by a reasonable interim period for full-term registration, not limited by considerations of nationality, domicile, or place of first commercial exploitation. This suggestion was spelled out in a July 9 letter from our Washington counsel (which is attached). We have also suggested, through counsel, some important technical clarifications of interpretation. I would be grateful if you could consider our suggestions in any conference proceedings.

In this connection, we have been asked whether EIAJ has a view as to probable or appropriate legislative action in Japan. Speaking on behalf of the semiconductor manufacturers of Japan, EIAJ recognizes the need for, and importance of, protection in Japan for the intellectual property embodied in semiconductor chips. Accordingly, we will ask the Government of Japan to provide such protection, as expeditiously as possible, through a new legislative framework.

Thank you for any consideration you can give to the approach we suggest. As always, my personal best wishes,

Sincerely yours,

Akio Morita

President
Electronic Industries
Association of Japan

Chairman and Chief Executive
Officer
Sony Corporation

ELECTRONIC INDUSTRIES ASSOCIATION OF JAPAN

TOKYO CHAMBER OF COMMERCE & INDUSTRY BUILDING
3-2-2, MARUNOUCHI, CHIYODA-KU, TOKYO
JAPAN

CABLE ADDRESS
EIAJAPAN TOKYO
TELEPHONE 3 [illegible]

July 18, 1984

Hon. Robert W. Kastenmeier
Chairman
Subcommittee on Courts, Civil Liberties
and the Administration of Justice
Judiciary Committee
U.S. House of Representatives
Washington, D.C. 20515
U.S.A.

Dear Rep. Kastenmeier:

The Electronic Industries Association of Japan (EIAJ) has been following the progress, through the Congress, of legislation that would afford a new form of protection for semiconductor chip products. In our view, the passage of such legislation is highly desirable, both of itself and as an indication of the proper direction for the international protection of such intellectual property. In this latter respect, we note the joint recommendations of the U.S.-Japan Work Group on High Technology Industries, made in November, 1983. One such recommendation of this government-to-government group was:

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ELECTRONIC INDUSTRIES ASSOCIATION OF JAPAN

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Sincerely yours,

Akio Morita
President
Electron Industries
Associ ion of Japan
Chairman Chief Executive Offic
Sony Cor ation

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June 27, 1986

Commissioner of Patents and Trademarks
Attn: Michael K. Kirk
Box 4
Washington, D.C. 20231

Re: 51 FR 18352

Dear Mr. Kirk:

This letter, plus Exhibits, constitute the written submission on behalf of the Electronic Industries Association of Japan ("EIAJ") in response to the Notice appearing at 51 FR 18352. We have already advised the PTO of our intention to appear at the hearing scheduled for July 9, and to make an oral presentation, with respect to Japan, on behalf of EIAJ at that time.

Exhibit 1 to this letter is EIAJ's written comments dated April 30, 1986, in response to the PTO's initial notice in this proceeding. These set forth EIAJ's reasons for urging the PTO to recommend the issuance of a Presidential Proclamation without further delay. Japan's law was enacted

more than one year ago; the registration system has been functioning, and issuing registrations, for six months.

Exhibit 2 is the Declaration of Kazuyoshi Toi, President of Japan's Industrial Property Cooperation Center ("IPPC"), prepared specifically for this proceeding. Mr. Toi confirms the following facts with respect to Japan's system for registering semiconductor integrated circuit designs:

-- The IPCC is a public interest foundation empowered to perform all necessary registration activities under strict government supervision.

-- Foreign corporations are entitled to receive, and do in fact receive, substantive and procedural treatment that is equal in every respect to treatment afforded domestic corporations.

-- In the opinion of Mr. Toi personally and the IPCC officially, measures for protection of trade secrets are almost identical to those provided for by U.S. Copyright Office regulations. This similarity is intentional

and results from study of U.S. regulations and advice from the U.S. Copyright Office.

-- As of today, all 342 applications received by the IPCC have resulted in registrations. 19 of these were from U.S.-based corporations.

-- The IPCC officials directly responsible for registration activities are all retired officials of Japan's Patent Office. NONE is from any semiconductor company or trade association.

-- None of the Officers or Directors of IPCC Foundation is from any semiconductor company or trade association.

-- The advisory Councillors to the Foundation (who are not Officers or Directors) are primarily from industry. These include the Representative Director and President of

Texas Instruments Japan Ltd., the President of Nippon Motorola Ltd., the President of Intel Japan K.K., and the Managing Director of IBM Japan Co.

Exhibit 3 is a blue-bound English language publication of the IPCC entitled "Outline of the Japanese System for Protection of the Circuit Layout of a Semiconductor Integrated Circuit." Mr. Toi affirms, in Exhibit 2, that this "Blue Book" was authored and published by IPCC, and he vouches, on behalf of IPCC, for the accuracy of its contents.

We respectfully submit that it should be evident that Japan has gone to extraordinary lengths -- not only to enact and implement a system, fully equivalent to the SCPA, with unmatched and unapproachable speed, but also to explain this system to the world, in English. It is time to give full, official recognition to this accomplishment.

Respectfully submitted,

Robert S. Schwartz

RSS:jd

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April 30, 1986

Commissioner of Patents and Trademarks
Attn: Michael K. Kirk
Box 4
Washington, D.C. 20231

Re: 51 FR 10073

Dear Mr. Kirk:

Attached please find the comments of the Electronic Industries Association of Japan ("EIAJ") in response to the PTO's notice appearing at 51 FR 10073. EIAJ believes that with respect to Japan, the case for a Presidential Proclamation is so clear that no hearing is required.

As in the past, on behalf of EIAJ we will be pleased to provide further information and cooperate in any proceedings you find appropriate.

Sincerely yours,

Robert S. Schwartz

Enclosures

RSS:jd

April 30, 1986

COMMENTS OF ELECTRONIC INDUSTRIES ASSOCIATION OF JAPAN ON EXTENSION OF INTERIM ORDERS UNDER SECTION 914 OF THE SEMICONDUCTOR CHIP PROTECTION ACT OF 1984 AND ISSUANCE OF PRESIDENTIAL PROCLAMATION UNDER SECTION 902

These comments are submitted on behalf of the Electronic Industries Association of Japan ("EIAJ") pursuant to the notice appearing in the Federal Register of March 24, 1986 (51 FR 10073). That notice invited comments as to whether the 13 interim orders under Section 914 of the Semiconductor Chip Protection Act of 1984 ("SCPA") that expire in 1986 ought to be extended, and whether any of the 14 interim orders issued thus far ought to be replaced by a permanent Presidential Proclamation under Section 902. As the original petitioner with respect to Japan (through its President, now Chairman), EIAJ will confine its comments to the case of Japan. EIAJ strongly urges that Japan's efforts and accomplishments, following the lead of the United States internationally, be rewarded by the issuance of the first Presidential Proclamation under Section 902.

EIAJ is a business association representing the major semiconductor manufacturers based in Japan. When EIAJ submitted a statement before the (then) Acting Commissioner on May 8, 1985 in support of issuance of the present interim order, it could already point to an extraordinary record of legislative accomplishment by the Government of Japan, with the assistance and advice of semiconductor manufacturers based both in Japan and the U.S. The simple goal of that endeavor was to join the United States Government in enacting a new form of protection for the intellectual (or industrial) property represented by semiconductor chip "mask works." This effort,

which even on May 8, 1985, was close to completion, has now been perfected. Japan's law is now in full effect, as are regulations that assure that U.S. entities and works receive treatment that is equal in every respect to that afforded domestic entities and works. Substantively, the protection is virtually identical to that provided by the SCPA.

In the May 8, 1985 statement, EIAJ pointed out that Japan's law, when enacted, would comply with both subsections 902(a)(2)(A) and (B), either of which, alone, would call for issuance of a Presidential Proclamation. Now that both the law and the implementing regulations are fully in place, there can be not a shadow of a doubt that Japan has done anything and everything that the drafters of the SCPA could have considered necessary to earn a Presidential Proclamation.

Subsection 902(a)(2)(A) makes a Presidential Proclamation appropriate for a foreign nation that protects mask works of U.S. entities "on substantially the same basis as that on which the foreign nation extends protection to mask works of its own nationals and domiciliaries and mask works first commercially exploited in that nation." The Japanese law, furthering the international purposes of the SCPA, contains no nationality or domiciliary requirement whatsoever. Nor do the Cabinet Order and Ministerial Ordinance that comprise the regulations governing registration. Indeed, these documents (translations of which have been provided to the PTO by the Government of Japan) lay to rest any fears that the registration system provides any opportunity for discrimination. For example, Article 24 of the Cabinet Order spells out specifically the only grounds on which registration may be dismissed. It limits these to cases of improperly filled out application forms, improper or omitted drawings, or non-payment of the fee. Thus, a Presidential Proclamation is appropriate because Japan's law provides protection that is unquestionably substantial, and is available to U.S. entities

on exactly the same basis on which it is available to Japanese entities.

Subsection 902(a)(2)(B) makes a Presidential Proclamation appropriate for a nation that affords protection for mask works of U.S. entities "on substantially the same basis as provided in this chapter." At pages 14 - 18 of the May 8, 1985 Statement, EIAJ demonstrated that Japan's law, then on the verge of final enactment, is, with respect to the protection afforded registrants, a close and intentional copy of the SCPA. In the year since, EIAJ has not become aware of any scholarship or analysis that would quarrel with this observation.* Moreover, it should be noted that the implementing regulations in Japan have filing, deposit, and confidentiality requirements very similar to their American counterparts, reflecting Japanese authorities' effort to make them compatible with those of the U.S. Copyright Office to the greatest extent possible. Accordingly, a Presidential Proclamation has been more than earned on the ground of substantive similarity, under 902(a)(2)(B), as well.

In listing new developments since the promulgation of interim orders last year, the PTO Notice observes: "[Q]uite importantly, the Japanese 'Law Concerning the Circuit Layout of a Semiconductor Integrated Circuit' has come into effect." The Notice also recounts the work at WIPO with respect to a draft treaty, and reprints the Memorandum of the Director General. That Memorandum notes, near its outset:

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* To the contrary, see Kastenmeier and Remington, The Semiconductor Chip Protection Act of 1984: A Swamp or Firm Ground? 70 Minn. L. Rev. 417, 463 n. 194 (1985), noting EIAJ's observation in this respect.

> In the United States of America and Japan, the two countries which, together and at the present time, produce some 80% of the world's microchips, the protection of intellectual property in integrated circuits is provided for by new laws. Those new laws provide for sui generis protection, that is, protection that is neither copyright nor patent.

It is remarkable that a document published barely more than a year after the enactment of the SCPA could go on to inform governments that translations of two sui generis laws are available for study. It shows the extent to which Japan has succeeded in endorsing, before the world, the fundamental intentions of the drafters of the SCPA-- to found a new system of protection, and to make it international as quickly as possible.

As the original petitioner with respect to Japan, EIAJ submits that there can be nothing further to offer or prove. There can be no question that justly and fittingly, Japan should receive the first Presidential Proclamation before the present interim order expires.* We urge the PTO and the Secretary to recommend to the President that Japan's full and complete compliance with the Act and recognized international support for this U.S. intellectual property initiative be acknowledged by the issuance of a Presidential Proclamation under Section 902 of the Semiconductor Chip Protection Act of 1984.

[Exhibits 2 and 3 are available for public use by contacting the Subcommittee on Technology and the Law directly.]

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* Of course, if there should be some delay in issuance of a Presidential Proclamation, the interim order under Section 914 should be made coextensive with the Secretary's authority rather than be allowed to lapse.

WISCONSIN LAW REVIEW
University of Wisconsin Law School
Madison, Wisconsin 53706

February 25, 1987

Senator Patrick Leahy
Chairman, Senate Subcommittee on Law and Technology
815 Hart Senate Office Building
Washington, D.C. [illegible]

Dear Senator Leahy:

It has come to my attention that you are holding a hearing on the possible extension of Section 914 of the Semiconductor Chip Protection Act beyond its expiration date of November 8, 1987. I would like to offer some thoughts on this topic and have this letter entered into the printed hearing record.

I have written a law review article about Section 914 as it has been applied so far. The article, PROTECTION OF UNITED STATES SEMICONDUCTOR DESIGNS IN FOREIGN COUNTRIES UNDER THE SEMICONDUCTOR CHIP PROTECTION ACT OF 1984, will be published in mid-March at 12 RUTGERS COMPUTER AND HIGH TECHNOLOGY LAW JOURNAL 501. It provides an examination of the hearings generated by foreign petitions for interim protection. Please refer to the enclosed copy in considering the future viability of Section 914. The article provides documentation of and basis for the following remarks.

In administering Section 914, the Patent and Trademark Office (PTO) has undermined the Legislature's goal of providing meaningful protection to American mask works because it has indiscriminately granted identical orders to all fourteen countries petitioning for interim protection. Despite extensive testimony at the petition hearings, the PTO decisions give no indication of what the U.S. will require of foreign nations seeking to qualify for permanent protection.

The petitions varied in four significant ways which the PTO should have responded to with differential treatment: stage of legislation, form of proposed protection, importance to the U.S., and amount of piracy. First, the arbitrary selection of one year as the duration of each interim order was inappropriate because the applicant countries were each at varying stages of progress in providing legal protection to U.S. chip designs.

Second, the form of legislation proposed by the petitioners varied in important ways. For example, the EEC planned to issue a "directive" purporting to require the member nations to enact specific legislation. A directive, as opposed to a regulation, cannot be relied on in court. The EEC could have chosen to enact a regulation to provide real legal protection. However, the EEC proposes a directive which it does not even expect all of its members to comply with. When asked during the hearing whether the directive would succeed in getting member countries to enact appropriate legislation, the EEC spokesman admitted "Well, Mr. Commissioner, there are no guarantees in life".

Third, the countries applying for interim protection under Section 914 are of varying importance to U.S. interests. For example, both American Telephone and Telegraph (AT&T) and the Semiconductor Industry Association sent representatives to the hearing of Japan to oppose issuing an interim order of longer than six months, due to the enormous U.S. interest in hastening Japan's legislation and in retaining some control over its content.

Fourth, the differing levels of chip piracy in applicant countries should affect U.S. treatment of the petitions. This was an explicit legislative policy at the time the Act was passed, especially with respect to Japan. The PTO's identical treatment of all fourteen applicants contradicts Congress' intent to deal less favorably with nations that flagrantly copy U.S. mask works.

Therefore, if you extend Section 914, you should ensure that its administration will be responsive to differences in the petitions of applicant countries. Perhaps this can be done by requiring the PTO to issue an opinion on each petition it hears, or by administering the process yourselves. You should also take steps to ensure that petitions for permanent protection are scrutinized and responded to on an individual basis according to their merits. I think that Section 914 should indeed be extended, to encourage non-participating nations, such as Korea, to provide protection to U.S. chip designs.

Thank-you very much. Please send me a copy of the hearing record, if possible. After May 17, my address will be: Lyon & Lyon, thirty-fourth floor, 611 West Sixth Street, Los Angeles, CA 90017

Sincerely,

James T. Carmichael

James T. Carmichael, Associate Editor
University of Wisconsin Law Review

PROTECTION OF UNITED STATES SEMICONDUCTOR DESIGNS IN FOREIGN COUNTRIES UNDER THE SEMICONDUCTOR CHIP PROTECTION ACT OF 1984*

I. INTRODUCTION

Industry purchased fifteen billion dollars worth of semiconductor chips[1] in 1982, two-thirds of which were manufactured in the United States.[2] The United States was the unchallenged leader in semiconductor chip production until the 1970's, when Japan began to claim a larger share of the world market.[3] Part of the reason for Japan's increasing share was that its chip makers, instead of relying solely on their own product designs, often bought U.S.-made chips, carefully dissected them, and then sold copies of them.[4] Other countries have also "pirated" American chip designs.[5]

Copying gives a firm a significant advantage by avoiding start-up costs. To design a line of chips costs up to one hundred million dollars; the design can be duplicated without permission for fifty to one hundred thousand dollars.[6] Firms have claimed losses of tens of millions of dol-

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© Copyright reserved 1987 by James T. Carmichael.

* [insert biog. info.]

1. A semiconductor chip ("chip") is a wafer-thin slice of silicon. It is comprised of integrated circuits made of microscopic electrical connections that can perform thousands of complex logic functions. Chips are the building blocks of computers and, to a certain extent, of all new technology and industry. *See* Chesser, *Copyright Protection for Integrated Circuits: Reevaluating Old Ideas About New Competitive Processes*, 22 U. W. ONT. L. REV. 201, 201 (1984); Note, *Semiconductor Chip Protection: Changing Roles for Copyright and Competition*, 71 VA. L. REV. 249, 249 (1985); Comment, *ROMS, RAMS, and Copyright: The Copyrightability of Computer Chips*, 14 SW. U.L. REV. 685, 686-95 (1984).

2. Note, *supra* note 1, at 253 n.20.

3. ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT, THE SEMI-CONDUCTOR INDUSTRY: TRADE RELATED ISSUES 26 (1985); Telephone interview with U.S. Representative Robert Kastenmeier, Chairman, Subcommittee on Courts, Civil Liberties, and the Administration of Justice, which drafted the Semiconductor Chip Protection Act of 1984, *infra* note 16 [hereinafter Kastenmeier interview]; Chesser, *supra* note 1, at 212-13.

4. *The Semiconductor Chip Protection Act of 1984: Hearings on H.R. 1007 Before the Subcomm. on Courts, Civil Liberties, and the Administration of Justice of the Comm. on the Judiciary*, 96th Cong., 1st Sess. 40 (1979) (statement of A. Grove, President, Intel Corp.) [hereinafter *1979 Hearings*]; 130 CONG. REC. 115494 (daily ed. June 11, 1984) (statement of Rep. Zschau).

5. *1979 Hearings*, *supra* note 4, at 40. American firms have discovered foreign-made copies of their chips complete with their mistakes. 130 CONG. REC. H5494 (daily ed. June 11, 1984) (statement of Rep. Sawyer). Even some U.S. manufacturers engaged in piracy. Kastenmeier interview, *supra* note 3.

6. *The Semiconductor Chip Protection Act of 1984: Hearings on H.R. 1028 Before the Subcomm. on Courts, Civil Liberties, and the Administration of Justice of the Comm. on the Judiciary*, 98th Cong., 1st Sess. 28 (1983) (statement of F. Dunlap, Jr., Corporate

lars a year because of copying.[7] By greatly discouraging investment by American firms in the development of new chip products,[8] chip piracy has further eroded the technological competitive advantage of the United States.[9]

Until recently copying was perfectly legal.[10] U.S. copyright law does not apply to semiconductor chips because they are utilitarian.[11] Chip designs are usually unpatentable because of the high standard of inventiveness required for patentability.[12] Trade secret law applies only before the chip is sold; thereafter copying is not barred.[13] Because pirates do not "pass off" their chips as originals, they do not violate doctrines of unfair competition.[14] Concern with the decline of America's competitive advantage in chip sales prompted[15] Congress to enact the Semiconductor Chip Protection Act of 1984 ("SCPA").[16]

Section II of this Note describes the SCPA, which allows chip manufacturers in a foreign country to have their designs protected in the United States, provided that country prevents piracy of American prod-

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Counsel and Secretary, Intel Corp.) [hereinafter *1983 Hearings*]; H.R. REP. No. 781, 98th Cong., 2d Sess. 2-3, *reprinted in* 1984 U.S. CODE CONG. & ADMIN. NEWS 5750, 5751 [hereinafter HOUSE REPORT]; S. REP. NO. 425, 98th Cong., 2d Sess. 5 (1984) [hereinafter SENATE REPORT].

7. SENATE REPORT, *supra* note 6, at 5. A Japanese firm copied a chip designed by Zilog Corp., a California chip manufacturer, and sold it in the United States at half-price, causing Zilog to lose between ten and twenty million dollars in expected sales. 130 CONG. REC. H5494, *supra* note 4 (statement of Rep. Zschau).

8. *1983 Hearings*, *supra* note 6, at 28.

9. 130 CONG. REC. H5492 (daily ed. June 11, 1984) (statement of Rep. Fish). One author, however, argues that chip copying enhances competition, does not harm the industry, and is generally good for the economy. Chesser, *supra* note 1, at 207; Note, *supra* note 1, at 289.

10. Interim Protection for Mask Works of Nationals, Domiciliaries and Sovereign Authorities of the United Kingdom of Great Britain and Northern Ireland, 50 Fed. Reg. 24,666, 24,668 (1985); Chesser, *supra* note 1, at 214-16.

11. Chesser, *supra* note 1, at 214-16.

12. *Id.*

13. *Id.*

14. *Id.*

15. Representative Glickman's argument is typical of the Congressional discussion: The Semiconductor Chip Protection Act protects "the technological advances which are necessary to keep this Nation of ours at the forefront of the world economy." 130 CONG. REC. H5496 (daily ed. June 11, 1984). *See id.* (statement of Rep. AuCoin); *id.* at H5493 (statement of Rep. Mineta); 130 CONG. REC. at S5837 (daily ed. May 16, 1984) (statement of Sen. Mathias). However, the chairman of the congressional subcommittee that drafted the SCPA believes its purpose was primarily to encourage innovation, rather than to protect U.S. industry from foreign competition. Letter to author from Rep. Robert Kastenmeier (Nov. 18, 1985).

16. Semiconductor Chip Protection Act of 1984, 17 U.S.C. §§ 901-914 (Supp. III 1985).

ucts.[17] For the first three years of the SCPA, the Patent and Trademark Office ("PTO") can give temporary protection to a country if it is making progress toward full protection of U.S.-made chips.[18] On November 8, 1987, the PTO's authority to grant interim SCPA coverage will cease.[19] The United States must then decide which countries should receive permanent protection for their chip designs.[20]

Section III of this Note examines the manner in which the PTO has handled the widely varying applications for interim protection, and finds that the PTO has indiscriminately approved them all. Section IV sets forth reasons why the United States should be more responsive to differences in such applications in order to achieve maximum protection for its chip designs in foreign countries. It suggests four areas in which the applications varied and discusses their significance to the United States in determining whether the foreign nation will adequately prevent piracy of American semiconductor layouts: the country's stage of progress toward legislation, the form of the legislation proposed, the importance to U.S. firms, and the amount of copying. Section V concludes that the United States should differentiate carefully among the applications before it decides which countries should receive permanent SCPA coverage after 1988, in order that the United States receive meaningful protection in return.

II. THE SEMICONDUCTOR CHIP PROTECTION ACT OF 1984

The SCPA protects the design of a chip if it (a) is owned by an American, (b) is first sold in the United States, or (c) comes under a Presidential proclamation.[21] The design is protected against anyone producing or selling a duplicate in the United States[22] for ten years.[23]

The SCPA borrows the "substantial similarity" standard from copyright law to determine whether infringement has occurred.[24] Computation of damages is also similar to that found in the U.S. Copyright Act.[25] Courts can issue injunctions[26] and order the seizure and destruction of infringing products.[27] The owner of the chip design can

17. *See infra* text accompanying notes 29-32.
18. *Id.*
19. 17 U.S.C. § 914(e).
20. *Id.*
21. 17 U.S.C. § 902(a)(1).
22. 17 U.S.C. § 905.
23. 17 U.S.C. § 904.
24. H.R. REP. No. 781, 98th Cong., 1st Sess. 26 (1984).
25. *Id.* at 25-28.
26. 17 U.S.C. § 911(a).
27. 17 U.S.C. § 910(c)(2).

choose either actual damages plus the pirate's profits or statutory damages of up to $250,000.[28]

Of course, foreign firms could still sell their duplicates in other countries, unless those countries also outlawed replication of U.S. designs. The SCPA has a provision encouraging other countries to prevent production or sale of infringing chips.[29] It extends coverage to the chip layouts of foreign manufacturers if their home country, in return, prevents copies of American chips from being manufactured or sold within its jurisdiction.[30] To qualify, the foreign country's protection of U.S. chips must be "(A) on substantially the same basis as that which the foreign nation extends" to its own designs," or "(B) on substantially the same basis as provided in this chapter."[31] The applicant country can be granted interim protection for up to three years if it is "making good faith efforts and reasonable progress toward . . . enacting legislation that would be in compliance with" subsection (A) or (B).[32]

III. ISSUANCE OF INTERIM ORDERS UNDER SCPA

The U.S. Patent and Trademark Office ("PTO") is responsible for handling applications for interim orders.[33] The effective date of the SCPA was November 8, 1984.[34] By June 28, 1985, the PTO had received petitions from fourteen countries seeking protection of their semiconductor chip designs in the United States.[35] As of October 21, 1985, the PTO had not received any more applications, and, because the fourteen countries account for nearly all of the foreign semiconductor

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28. 17 U.S.C. § 911(b)-(c).
29. 17 U.S.C. § 902(a)(2).
30. *Id.*
31. *Id.*
32. 17 U.S.C. § 914(a)(1), (e).
33. Interim Protection for Mask Works of Japanese Nationals, Domiciliaries and Sovereign Authorities, 50 Fed. Reg. 24,666, 24,668 (1985).
34. Interim Protection for Mask Works of Japanese Nationals, Domiciliaries and Sovereign Authorities, 50 Fed. Reg. 12,355, 12,356 (1985).
35. Telephone interview with Michael Keplinger, Assistant Commissioner, U.S. Patent and Trademark Office, panel member for section 914 hearings (Sept. 24, 1985); *see* Interim Protection of Mask Works of Japanese Nationals, Domiciliaries and Sovereign Authorities, 50 Fed. Reg. 12,355 (1985); Interim Protection for Mask Works of Swedish Nationals, Domiciliaries and Sovereign Authorities, 50 Fed. Reg. 18,720 (1985); Interim Protection for Mask Works of Nationals, Domiciliaries and Sovereign Authorities of the United Kingdom of Great Britain and Northern Ireland, 50 Fed. Reg. 24,666 (1985); Interim Protection for Mask Works of Nationals, Domiciliaries and Sovereign Authorities of the Netherlands, 50 Fed. Reg. 24,795 (1985); Interim Protection for Mask Works of Nationals, Domiciliaries and Sovereign Authorities of Canada, 50 Fed. Reg. 25,288 (1985); Interim Protection for Mask Works of Nationals, Domiciliaries and Sovereign Authorities of the European Economic Community, 50 Fed. Reg. 26,821 (1985).

production, did not expect any.[36] The PTO was generally unresponsive to differences between the applications. It granted all fourteen petitions,[37] taking nearly identical action in each case and providing little explanation.[38]

Thirteen of the applicant countries—Japan,[39] Sweden,[40] Australia, the Netherlands,[41] Canada,[42] Belgium, Denmark, France, Germany, Greece, Ireland, Italy, and Luxembourg[43]—received interim protection orders lasting exactly one year.[44] Many of these countries were grouped together, with the result that the PTO wrote only five opinions to accompany the thirteen interim orders.[45]

The PTO used the same language in its opinion granting the European Economic Community's ("EEC") application as it did in Canada's case: "However, we recognize that the activities of [name of country] are in a preliminary stage of development. We have determined that a review of progress would be appropriate, but the order should be long enough to permit [name of country] to make significant progress toward developing its own legislation."[46] The PTO uses substantially the same language in two of the three other opinions, substituting "not as specific as is the U.S. legislation" instead of "in a preliminary stage of development."[47] In the remaining opinion, the PTO gives no reasoning at all that is specific to the applicant countries. Indeed, the PTO does not even state that it is granting the United Kingdom the only three-year

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36. Telephone interview with Lee Skillington, spokesman for the PTO (Oct. 21, 1985).

37. *Id.*

38. The applications of four of the countries were not subject to hearings, but were granted on the basis of the countries' statements that their current copyright laws already protect U.S. chip designs by virtue of membership in the Uniform Copyright Convention. These orders to Australia, the United Kingdom, Canada, and the Netherlands were not in response to the strength of the petitions; rather, they were based on a statement from congressional debates that countries asserting that they can already protect chip designs should receive expedited processing. In fact, none of the applicants could cite any statutory or case law authority to support its assertions. *See* 50 Fed. Reg. at 24,665, 24,667, 24,795, 25,289.

39. 50 Fed. Reg. at 24,668.

40. 50 Fed. Reg. at 25,618.

41. 50 Fed. Reg. at 26,818.

42. 50 Fed. Reg. at 27,649.

43. Belgium, Denmark, France, Germany, Greece, Ireland, Italy, and Luxembourg applied together as the European Economic Community. 50 Fed. Reg. at 37,892.

44. For no explicit or apparent reason, the United Kingdom received an order lasting three years. 50 Fed. Reg. at 26,818.

45. *See* 50 Fed. Reg. at 24,668, 25,618, 26,818, 27,649, 37,893.

46. 50 Fed. Reg. at 27,650, 37,893.

47. 50 Fed. Reg. at 24,669, 25,619.

interim order, much less explain its reasons.[48] The PTO uses the same sentence in three of the five opinions: "This will permit a review of progress on a timely basis without unduly burdening either the parties to this proceeding or the government."[49]

These passages constitute a substantial portion of the brief explanations.[50] In light of the fact that the application and hearing process generated up to ninety pages of testimony per country,[51] these short and generalized opinions do not explain what the PTO considers acceptable legislation.[52] They do not address the problems that the foreign countries may face[53] with their legislation when they seek permanent protection under section 902.[54]

The PTO's principal reason for treating the various applications indifferently appears to have been administrative efficiency. The PTO stated that it granted one-year orders to nearly all applicants to ease its administrative tasks.[55] Other reasons may include the desire to preserve the goodwill shown thus far by applicant countries[56] and to allow them to help determine the operation of the SCPA. A report from the House Committee on the Judiciary suggests that international evaluation of the SCPA should be "carefully and sympathetically followed."[57] While these reasons may support the PTO's decision to give nearly identical treatment to all countries and to refrain from resolving uncertainties, they may not overcome the advantage of ensuring that the foreign countries provide meaningful protection for U.S. chip designs that the United States could gain from being responsive and explicative.[58]

IV. ANALYSIS OF THE DIFFERENCES BETWEEN INDIVIDUAL SCPA APPLICATIONS

The applications of foreign countries for protection under the SCPA

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48. 50 Fed. Reg. at 24,669, 27,650, 37,894.

49. *See* 50 Fed. Reg. at 26,818-20.

50. *See* 50 Fed. Reg. at 24,669, 25,619, 27,650, 37,894.

51. *See* 50 Fed. Reg. at 18,720-23; *see also, e.g., Hearing in the Matter of Issuance of an Interim Order for Sweden Permitting Swedish Companies to Register Their Semiconductor Mask Works in the U.S. Under the Semiconductor Chip Protection Act of 1984*, Patent and Trademark Office (May 29, 1985) [hereinafter *Hearing of Sweden*].

52. *See supra* note 45.

53. *See infra* notes 82-113 and accompanying text.

54. 17 U.S.C. § 902 (1984).

55. Telephone interview with Lee Skillington, spokesman for the PTO (Oct. 21, 1985).

56. The SCPA has been well received worldwide. Kastenmeier interview, *supra* note 3.

57. HOUSE REPORT, *supra* note 6, at 18.

58. *See infra* notes 59-121 and accompanying text.

vary in four areas that could influence the effectiveness of the SCPA: (1) the stage of progress of the applicant country, (2) the form of proposed legislation, (3) the importance to the United States of protection of its own chips in the applicant country, and (4) the level of existing piracy.[59] The impact of these differences should be weighed against the concern for administrative efficiency.[60]

First, the arbitrary selection of one year as the duration of each order was inappropriate because the applicant countries were all at different stages in their progress toward legal protection of U.S. chip designs. For example, Canada asserted that its legislation would be drafted within five or six months.[61] Similarly, Japan's bill was moving very rapidly toward finalization. The effective date of the SCPA was November 8, 1984.[62] By January 22, 1985, a Japanese subcommittee had recommended enactment of legislation similar to the SCPA. By March, Japan's Ministry of International Trade and Industry had drafted a bill and attempted to introduce it in the Diet.[63] The bill passed the Lower House on May 8, 1985.[64] Japan, at its hearing, agreed that its bill was quickly becoming law.[65] The U.S. Semiconductor Industry Association ("SIA") argued that the PTO should limit its order to six months in Japan's case to allow a review of progress and to exert leverage over the provisions of the law before it became final.[66] Solely in the interest of administrative ease,[67] protection for Japan and the other applicants was granted subject to review in exactly one year,[68] even though Japan's law may be immutable by that time.

The SIA notes that, in contrast to Japan, a review of Sweden's application could not prove fruitful for at least one year due to the slow, cumbersome workings of the Swedish legislature.[69] The author of Sweden's proposed bill testified that it would not be drafted for about a

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59. *See infra* notes 61-113 and accompanying text.

60. *See supra* text accompanying notes 55-58.

61. 50 Fed. Reg. at 25,291 (1985).

62. 50 Fed. Reg. 12,355 (1985).

63. *Id.* at 12,358 (letter from Japan's Ministry of Int'l Trade and Indus. to the U.S. Patent and Trademark Office, dated March 4, 1985).

64. *Hearing in the Matter of Ministry of Int'l Trade and Indus. (Japan)*, Patent and Trademark Office, at 25-51 (May 8, 1985) (statement of Elec. Indus. Ass'n of Japan) [hereinafter *Hearing of Japan*].

65. *Id.* at 29.

66. *Id.* at 22.

67. *See supra* text accompanying note 55.

68. *See supra* notes 30-36 and accompanying text.

69. *Hearing of Sweden*, *supra* note 51, at 23 (statement of R. Michael Gadbaw, Semiconductor Indus. Ass'n).

year.[70]

The testimony of the European Economic Community ("EEC") indicated that it hoped to propose legislation in six months, but, because the issues involved many countries and were very complex, no bill could possibly pass for at least eighteen months.[71] The EEC emphasized that the United States could expect no action during an interim period of only one year.[72] Furthermore, the proposal that the EEC planned to discuss was a directive, rather than a regulation.[73] A directive cannot be relied on as a law; rather, it obliges member states to make their laws correspond to its provisions.[74] Once a directive has finally been approved, the EEC countries have a certain amount of time to comply, in this case eighteen additional months.[75] Thus, enactment of legislation in the member nations is a long, slow process, and one year is insufficient to see progress worth reviewing.[76] Thus, arbitrarily granting orders of one year does not necessarily correspond to the PTO's goal of "a review of progress on a timely basis,"[77] since it will be too late to exert leverage over countries with completed legislation[78] and frequently too early to effect changes elsewhere.[79]

Second, the form of legislation proposed to prevent foreign piracy of U.S. designs varies from country to country. For example, Japan's bill was complete, with a *sui generis* approach very similar to the SCPA.[80] On the other hand, not all applicants offered detailed legislation specifically modeled on the SCPA. This difference between applications may be very important in determining whether the United States receives something meaningful in return for its protection of the applicant countries' chip designs.[81] The EEC expects only partial compliance with its directive from its members.[82] Some of the nations, the EEC concedes,

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70. *Id.* at 35 (statement of Henry Olsson, Director, Sweden Ministry of Justice).

71. *Hearing in the Matter of the Interim Protection for Mask Works of Nationals, Domiciliaries and Sovereign Authorities of the European Economic Community*, Patent and Trademark Office, at 28 (July 23, 1985) (testimony of Robert Coleman, EEC) [hereinafter *Hearing of EEC*].

72. *Id.*

73. *Id.* at 6-8.

74. *Id.*

75. *Id.* at 14.

76. *Id.* at 28.

77. 50 Fed. Reg. at 24,669 (1985).

78. *See supra* text accompanying notes 58-66.

79. *See supra* text accompanying notes 71-77.

80. *Hearing of Japan*, *supra* note 63, at 29-30.

81. *Hearing of EEC*, *supra* note 71, at 8-11.

82. When asked whether the directive would succeed in getting member nations to protect U.S. chip designs, the EEC's spokesman admitted: "Well, Mr. Commissioner, there are no guarantees in life." *Id.* at 9.

will refuse to protect U.S. chips.[83] Because some of the EEC countries have already attempted to register chip layouts under the SCPA,[84] it is very likely that the United States will be obliged, as a result of the interim orders, to protect designs of countries that do not and will not protect those of the United States. For example, the EEC could have chosen to propose a regulation instead of a directive. Regulations directly bind citizens of the member states, rather than imposing obligations on the governments which they may refuse.[85] Regulations may be relied on in the courts of member countries by other nations seeking to enforce them;[86] directives may not.[87] Thus, the form of legislation proposed may seriously affect whether U.S. chip designs are protected against piracy in the EEC countries.

Other applicant countries do not intend to propose new legislation at all. Australia, the United Kingdom, and the Netherlands base their applications solely on the assertion that their copyright law, by virtue of membership in the Uniform Copyright Convention ("UCC"), extends to U.S. chip layouts.[88] The UCC requires its members to protect works of all other UCC countries, including the United States, just as it protects its own works under copyright laws.[89] None of the three countries, however, had express statutes or case law providing copyright protection to semiconductor chips.[90] Thus, protection of U.S. designs in Australia, the United Kingdom, and the Netherlands is uncertain, and those countries do not plan to enact explicit legislation to make protection clear.[91] Canada and Sweden, on the other hand, are making progress toward enacting specific laws, despite their assertions that their

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83. *Id.* at 11.

84. *Id.* at 10.

85. *Id.* at 6.

86. *Id.*

87. *Id.*

88. 50 Fed. Reg. at 24,667-68.

89. 50 Fed. Reg. at 24,668. If the United States had written the SCPA as an amendment to its copyright laws, as was originally proposed, the United States would have had to extend this coverage to Uniform Copyright Convention members, whether or not those countries protected U.S. chip designs. The United States would have incurred a unilateral obligation to protect countries such as Japan and the Soviet Union. Note, *supra* note 1, at 286. At its hearing, Japan suggested that this was the reason the SCPA was enacted as *sui generis* law. *Hearing of Japan*, *supra* note 63. This assertion was denied by the chairman of the subcommittee responsible for drafting the SCPA. Kastenmeier interview, *supra* note 3.

90. 50 Fed. Reg. at 24,796.

91. The chairman of the congressional subcommittee that drafted the SCPA stated it would be inappropriate to grant permanent protection to a country, such as the United Kingdom, that based its application on an unsupported assertion that its copyright laws cover U.S. chip designs. Letter to author from Rep. Robert Kastenmeier (Nov. 18, 1985).

copyright statutes already cover chip layouts.[92] The form of protection in Canada and Sweden, definite legislation, would be more certain to provide coverage to U.S. chips.

Even if an applicant country's copyright laws covered chips, and the country were a UCC member, there would still be important differences between that coverage and the SCPA.[93] For example, if a country protected semiconductor designs under its copyright laws, it would be subject to the registration and notice requirements of any international copyright treaties to which it was a party. Australia, the United Kingdom, and the Netherlands are members of the UCC. Sweden is a member of the Berne copyright convention.[94] Neither the UCC nor the Berne convention provides for registration of works or the affixing of a uniform symbol to the work to provide notice of protection.[95] The SCPA, however, requires the owner of a semiconductor layout to register it.[96] Registration, the SIA states, better allows determination of whether a right in a design has been infringed.[97] The SCPA also allows the owner to affix a special symbol, an "M" in a circle, to his chips.[98] This symbol provides prima facie evidence of notice of protection, which is helpful to rebut a claim of innocent infringement.[99] Since an innocent infringer is basically immune from liability under the SCPA,[100] use of the symbol to rebut such a claim is important to enforce the rights of a chip owner under the SCPA.[101] A country asserting that it covers U.S. chips under its copyright laws may not allow U.S. manufacturers to register their designs or employ the SCPA symbol as notice of protection.[102] Thus, when protection of chip designs takes the form of copyright, it may not be on the same basis as the

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92. *Hearing of Sweden*, *supra* note 51, at 43 (testimony of Henry Olsson, Director, Sweden Ministry of Justice); 50 Fed. Reg. at 25,291.

93. 50 Fed. Reg. at 26,819 (letter from the SIA to the PTO).

94. *Hearing of Sweden*, *supra* note 51, at 57 (testimony of Henry Olsson, Director, Sweden Ministry of Justice).

95. *Id.* at 55-58.

96. 17 U.S.C. § 908.

97. 50 Fed. Reg. at 26,819.

98. 17 U.S.C. § 909.

99. *Id.*

100. 17 U.S.C. § 907; *Hearing of Sweden*, *supra* note 51, at 75-76 (testimony of Richard Stern, consultant to the World Intellectual Property Organization).

101. *Hearing of Sweden*, *supra* note 51, at 76; *id.* at 16-20 (testimony of R. Michael Gadbaw, Semiconductor Indus. Ass'n). Sweden concedes that even though its proposed legislation would not recognize the SCPA's symbol of notice, such a provision would prevent some infringers from claiming they did not know the chip was protected against copying. *Id.* at 54-57 (testimony of Henry Olsson, Director, Sweden Ministry of Justice).

102. *Id.* at 16-20 (testimony of R. Michael Gadbaw, Semiconductor Indus. Ass'n); *id.* at 70 (testimony of Richard Stern, consultant to the World Intellectual Property Organization); 50 Fed. Reg. at 26,819 (letter from the SIA to the PTO).

SCPA,[103] making the applications of Australia, the United Kingdom, and the Netherlands even more questionable.

Third, in addition to the stage of progress and the form of the proposed legislation, the importance to the U.S. semiconductor industry of gaining protection in a given country should affect the PTO's treatment of the various applicants. For example, it is very important to the United States to have adequate coverage of its chips against Japanese copying. As the president of a large U.S. chip manufacturer states, "[i]f the pirating is done by the Japanese, the effect is doubly serious."[104] Japan makes eighteen percent of the chips sold in America. Thus the United States has a larger incentive with its competitor Japan than with other countries to ensure coverage against copying.[105] American Telephone and Telegraph ("AT&T") opposed the issuance of any interim order to Japan, for fear it would encourage the Japanese to delay passage of legislation preventing them from copying U.S. chips.[106] The SIA urged that any interim order issued to Japan be limited to six months because of the large U.S. interest involved.[107]

The United States should grant Sweden a longer order because its semiconductor industry poses less of a threat than Japan's, according to the SIA.[108] Similarly, it may be prudent for the United States to take a tough stance against weaknesses[109] in the Netherlands' application, as that country expects other European countries to follow its example.[110] The premise, of course, is that the United States will benefit by refusing to grant, or by reducing the length of, orders giving SCPA coverage to the countries from which the United States most wants protection. In this manner, the PTO might better balance the need to exert influence over the content and speed of passage of foreign legislation with its professed administrative concerns.

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103. It may be that the SCPA will not be construed as wholly separate from the U.S. Copyright Act. The SCPA drafting committee intended the SCPA to rely on the Copyright Act for many interstitial questions of interpretation. HOUSE REPORT, *supra* note 6, at 26. The PTO states that the SCPA is "based in part" on the Copyright Act, and may be affected by its provisions. 50 Fed. Reg. at 26,820 (1985). One author calls the SCPA an amendment to the Copyright Act "masquerading as *sui generis* law." Note, *supra* note 1 at 286 (italics added).

104. *1979 Hearings*, *supra* note 4, at 32.

105. *Hearing of Sweden*, *supra* note 51, at 23 (testimony of A. Michael Gadbaw, Semiconduct9or Indus. Ass'n).

106. 50 Fed. Reg. at 24,669.

107. "Japan is our largest—is the second largest market in the world for semiconductors." *Hearing of Sweden*, *supra* note 50, at 23 (testimony of A. Michael Gadbaw, Semiconductor Indus. Ass'n).

108. *Id.* at 21-23.

109. *See supra* text accompanying notes 89-103.

110. 50 Fed. Reg. at 24,796, 24,799.

Fourth, the varying levels of chip piracy also suggest that the United States should take separate actions on different applications. Speaking to Congress, the chairman of the SCPA drafting subcommittee stated that the amount of copying taking place in an applicant country should be considered in evaluating requests for interim protection.[111] This indication of legislative intent was even noted by the PTO with respect to Japan.[112] The extent of Japanese chip piracy was the major reason for enactment of the SCPA, as documented in the legislative history.[113] The identical treatment of all applicants appears directly contrary to Congress's intent to deal less favorably with nations which copy U.S. designs. The stage of progress, the form of proposed legislation, the importance to the United States of protection, and the level of piracy all vary from country to country, and each suggests that the United States should not treat all SCPA applicants alike.

The messages that differential treatment could send would help ensure proper legislation to protect American chip designs, as the applicant countries are responsive to direction from the United States. For example, Japan has repeatedly stated that it will respond to U.S. demands and even follow American case law.[114] Japan further testified that its reaction would depend on the length of the interim order granted.[115] It asserted that a longer order would encourage it to use the SCPA in the proper way. A shorter order, Japan said, would cause its industry to become skeptical and gain SCPA coverage instead by transferring chip design rights to its American subsidiaries or by selling a chip in the United States first.[116] The SIA has emphasized that leverage over the provisions of an applicant's proposed legislation can be exercised by official review of a country's progress.[117] Sweden has indicated that it is open to U.S. suggestions during the development of its chip protection law,[118] as has the EEC.[119] Each applicant has empha-

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111. 50 Fed. Reg. at 12,357 (quoting 130 CONG. REC. E4434 (daily ed. Oct. 10, 1984) (statement of Robert Kastenmeier, Chairman, Subcomm. on Courts, Civil Liberties, and the Administration of Justice)).

112. *Id.*

113. *See supra* notes 3-15 and accompanying text. Japan denies the existence of chip piracy by its semiconductor industry. 50 Fed. Reg. at 12,358 (letter from Japanese Ministry of Int'l Trade and Indus. to the PTO).

114. *See Hearing of Japan, supra* note 63, at 34, 37, 41-42.

115. *Id.* at 50.

116. *Id.* at 50. Under 17 U.S.C. § 902(a)(1), coverage is granted to any foreign semiconductor design that is first sold in the United States.

117. *Hearing of Japan, supra* note 63, at 22 (statement of A. Michael Gadbaw, Semiconductor Indus. Ass'n).

118. *Hearing of Sweden, supra* note 51, at 58 (testimony of Henry Olsson, Director, Sweden Ministry of Justice).

119. *Hearing of EEC, supra* note 71, at 14.

sized that protection of its chip designs is important to it.[120] Given this position, it seems likely that the United States could send messages through its actions, to which foreign countries would respond by remedying the weaknesses in their protection of U.S. semiconductor designs.

V. CONCLUSION

Congress enacted the Semiconductor Protection Act of 1984 in response to the decline of the American semiconductor industry, a decline hastened by foreign copying of U.S. chip designs. To prevent pirates from selling their duplicates on the world market, the SCPA offers coverage to the designs from countries that, in return, protect American chip layouts. To encourage countries to enact legislation to comply, the SCPA permits the Patent and Trademark Office to issue interim orders extending SCPA protection for up to three years. The PTO has taken nearly identical action on all fourteen petitions for interim orders and has provided little guidance to applicants, even though the foreign countries would be responsive to such guidance. The United States will be better assured of protection against foreign chip pirates if it varies its responses according to a country's stage of progress in enacting legislation, the form of proposed legislation, the importance to American firms of gaining protection in the applicant country, and amount of copying in that country. The World Intellectual Property Organization and the Semiconductor Industries Association suggest that a more thorough review of a foreign country's proposed legislation is appropriate before any permanent protection is granted.[121] Each review should result in a complete, individualized response from the United States.

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120. *See* 50 Fed. Reg. at 12,357, 24,796, 26,823, 27,650; *Hearing of Sweden*, *supra* note 51, at 36 (testimony of Henry Olsson, Director, Sweden Ministry of Justice).

121. *Hearing of Sweden*, *supra* note 51, at 58 (testimony of Richard Stern, consultant to the World Intellectual Property Organization); 50 Fed. Reg. at 26,819 (letter of comment from the Semiconductor Indus. Ass'n).